MAY

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

copy 4

Pulpless Tooth as Seen by Physician —*Miller*
Pulpless Tooth as Seen by General Practitioner of Dentistry—*Johnson*
Balanced Occlusion—*Little*
Study of Maxillary Sinuses—*Boyne*
Prevention in Dentistry—*Black*
Tissue Lesions and Hypotonus—*Gearhart*
Radiography—*Jackson*
Tumors of Mouth—*Sherrill*
Traumatic Occlusion—*House*

EDITORIALS

A Change of Policy
Ethics in Professional Journalism

DENTAL HEALTH EDUCATION

Periodic Prophylaxis—*Hayden*
Conserving First Permanent Molars—*Hyatt*
Food and Nutrition—*Daum*

PROPERTY OF
DENTAL LIBRARY
UNIVERSITY OF MICHIGAN
DO NOT MUTILATE OR REMOVE

CONTENTS

Officers of the Section on Exodontia, Anesthesia and Roentgenology, Seventh International Dental Congress ..... Frontispiece

ORIGINAL COMMUNICATIONS

The Problem of the Pulpless Tooth as Seen by the Physician.
By Joseph L. Miller, M.D. 535
The Problem of the Pulpless Tooth as Seen by the General Practitioner of Dentistry.
By C. N. Johnson, M.A., D.D.S. 546
Balanced Occlusion—Its Practical Application in Partial Denture Construction.
By Arthur Paul Little, D.D.S. 553
A Study of Forty-Three Maxillary Sinuses.
By Harry N. Boyne, M.S., D.D.S. 574
Prevention in Dentistry.
By Arthur D. Black, A.M., M.D., D.D.S., Sc.D. 582
Lesions of Gum Tissues and Their Relation to Vascular Hypotonus.
By Clyde M. Gearhart, D.D.S. 595
Radiography from the Point of View of the Prosthodontist.
By Howard H. Jackson, D.D.S. 601
The Diagnosis of Tumors of the Mouth.
By J. Garland Sherrill, M.D. 613
Traumatic Occlusion as a Factor in Periodontia: Its Detection and Correction.
By M. M. House, D.D.S., F.A.C.D. 625
A Review of the Buckley-Price Debate.
By John Albert Marshall, D.D.S., Ph.D. 635
Diagnosis and Therapy of Vincent's Infection.
By Meyer Golob, M.D. 639
The End Organ of the Epithelial Sheath.
By Richard Landsberger 643

EDITORIAL DEPARTMENT

A Change of Policy 646
The Ethics of Professional Journalism 648
Suppressing Nostrums 649
The Gorgas Memorial 650
Officers of the Section on Physics, Chemistry and Metallurgy, Seventh International Dental Congress (Halftone) 651

DEPARTMENT OF DENTAL HEALTH EDUCATION

Clinical Results from Periodic Prophylactic Treatments.
By Gillette Hayden, D.D.S. 652
The Conservation of Noncarious First Permanent Molars.
By Thaddeus P. Hyatt, D.D.S., F.A.C.D. 655
Food and Nutrition.
By Kate Daum, Ph.D. 663
Mouth Health Week in Mississippi.
By Gladys Eyrich 667
Field Notes 670

NEWS DEPARTMENT

Medical and Dental News 671

The Gorgas Memorial Institute.
By Franklin H. Martin, M.D. 676

CURRENT LITERATURE

Extracts and Abstracts 678

ANNOUNCEMENTS

Calendar of Meetings (National, State, Examining Boards.)—The Dental Society of the State of New York.—North Dakota State Dental Association.—South Carolina State Dental Association.—Board of Dental Examiners of Alabama.—Arkansas State Board of Dental Examiners.—Board of Dental Examiners of California.—Board of Dental Examiners of the District of Columbia.—Florida State Board of Dental Examiners.—Iowa State Board of Dental Examiners.—Kentucky State Board of Dental Examiners.—Board of Dental Examiners of the State of Maine.—Maryland State Board of Dental Examiners.—Michigan State Board of Dentistry.—Minnesota State Board of Dental Examiners.—Mississippi State Board of Dental Examiners.—North Carolina State Board of Dental Examiners.—Ohio State Dental Board.—State Board of Dental Examiners of the State of Oklahoma.—South Carolina State Board of Dental Examiners.—Tennessee Board of Dental Examiners.—Board of Dental Examiners of the State of Wyoming.—Alumni Association, College of Physicians and Surgeons of San Francisco.—American Academy of Periodontology.—Official Notice to Dental Assistants Association.—Dinner to Dr. Weston A. Price.—Southwestern Society of Orthodontists.—Books Received.—Patents of Interest to Dentists.—The Profit Sharing Auxiliary of Commerce 682-690

ADVERTISING DEPARTMENT

Index to Advertisements A-69
Classified Section A-61, A-62, A-63

OFFICERS OF THE SECTION ON EXODONTIA, ANESTHESIA AND ROENTGENOLOGY, SEVENTH INTERNATIONAL DENTAL CONGRESS, PHILADELPHIA, PA., AUG. 23-27, 1926

THE JOURNAL
OF THE
American Dental Association

VOL. 13 MAY, 1926 No. 5

Original Communications

THE PROBLEM OF THE PULPLESS TOOTH AS SEEN BY THE PHYSICIAN*

By JOSEPH L. MILLER, M.D., Chicago, Illinois

ON receipt of the invitation to discuss the menace of the pulpless tooth, my first inclination was to decline, on the basis that this was merely a hypothesis, and speculative discussion has little place in a meeting of this character. After more deliberate consideration, I decided that a brief critical review of the available experimental and clinical evidence and a discussion of what is acceptable proof might be of interest. My discussion, therefore, will not be restricted to the pulpless tooth, but rather to the broader problem of focal infections.

My text is taken from an address of Sir William Osler: "In treatment the placid faith of the believer, not the fighting faith of the aggressive doubter, is our besetting sin."

Osler, thirty years ago, was called a therapeutic nihilist; but later his critics acknowledged that he had mastered therapeutics. It is interesting to speculate why his knowledge of this subject was so far in advance of that of his colleagues. Following his graduation, he spent two years abroad, studying physiology and pathology. On his return to Montreal, he was appointed professor of physiology and pathology, a position which he retained for ten years. As a result of his contact with the basic sciences, he acquired the habit of logi-

*Read at the Mid-Winter Clinic of the Chicago Dental Society, Feb. 27, 1926.

*Discussion of the papers of Drs. Miller and Johnson will be found on page 551.

cal reasoning, which characterizes the true scientist. His training in physiology made him familiar with the normal functions and responses of the body. The symptoms of disease are nothing more than the response of disturbed physiologic processes. By his study of pathologic anatomy, he became familiar with the anatomic changes responsible for these disturbed processes. His knowledge of the cellular changes in diseased organs enabled him to establish the limitation of therapeutic agents.

The truth of the foregoing text is revealed if we review the history of therapeutics during the past century. Cures have appeared, held sway for a varying period of time, and then vanished—evidence of their lack of virtue. The physician is a therapeutic optimist. He wishes to play an active rôle in the recovery of the sick, and is oftimes prone to assume credit that belongs to Dame Nature. This optimism should be nurtured and encouraged, but at the same time should pursue a logical course in order that the evidence collected may be capable of withstanding the closest scrutiny.

When we look back through the history of medicine, we find these recurrent waves of medical optimism, due to some current fad, which became more or less widespread, only gradually to wane and finally be forgotten except by the historians. Such a wave is not all dross, but contains a few grains of real gold, which is deposited and becomes a permanent part of medicine. In order to secure a better background, it may be well to review a few of these passing hobbies. What has occurred may be of some value in predicting the future.

A century ago, bleeding in all fevers was a common practice. It was the general impression that bleeding was beneficial. No one, apparently, went to the trouble of determining whether this procedure lowered mortality. Louis, the French clinician, was one of the first to utilize the control method in determining the value of the therapeutic procedure. He bled a series of pneumonia patients, and compared the mortality with that of a similar series given only the routine care in vogue at that time. His results indicated that bleeding was harmful rather than beneficial. He replaced impressions by observed facts. This introduction of the control method of studying disease was only one of many services rendered to medicine by Louis. Its importance can scarcely be overestimated and has been generally adopted as the rational method for determining the value of any therapeutic procedure. It is not infallible, but, when properly used, is certainly of great value.

Brown-Sequard's testicular juice was heralded as a cure-all. If you will consult the literature of that day and read the glowing accounts detailing its marvelous curative powers, you will almost become convinced. Today, Brown-Sequard's testicular juice is only a memory. Its advocates erred in their deductions.

Let us come down to events within the memory of many of those here. With the advent of vaccine therapy, our hopes were raised that, at last, a scientific means of treating infection had been discovered. As a therapeutic measure, it was adopted far and wide, and its advocates were not confined to

nations or continents. Leaders in the profession were free to praise its efficiency. An extensive literature developed in the course of a few years. Commercial druggists flooded the market with their products, and the medical journals with their advertisements. Only a comparatively few physicians were able to resist this wave and remain mere spectators. Scarcely fifteen years have elapsed since vaccine therapy reached its height; yet, today, the physician using vaccines would be looked on as an individual who had failed to keep abreast of the times.

It is interesting to read some of the literature of this date. It sounds surprisingly familiar: animal experiments; reports of cases covering the entire field of acute infections; startling recoveries; and everywhere a spirit of enthusiasm. Only rarely can we note a protesting voice, as it required not merely courage but also combativeness to attempt to stem the tide. The aggressive doubter was not strongly in evidence. There can be no discussion as to why vaccine therapy is now rarely resorted to. It did not merely fail to live up to expectations, but was finally shown to be of little, if any, value. It is evident now that the reported observations were false. The physician was mislead by his optimism. This is evidence again that the only sane method of determining the value of a therapeutic agent is to check it with adequate controls. Such control methods of observation were not employed. As in previous fads, all was not dross. The use of vaccines added to our knowledge of immunology and gave birth to what is known as foreign protein, or shock therapy, a form of reaction that bids fair to modify our present conception of immunology and the method of action of certain so-called specific drugs.

I will refer to only one more medical craze—ductless gland therapy. This differs from the hobby just described as, from the beginning, it has been vigorously opposed by the majority of outstanding men in the medical profession and by the physiologist and pharmacologist. When a medical fad enters the domain of the biologic sciences, an army of pure scientists rise to oppose it. Accustomed as they are to the more careful study of cause and effect, they are quick to apprehend the inadequacy of the evidence presented. This subject will be dismissed by quoting Arthur Cushney, the Scottish pharmacologist. Having discussed in detail the suprarenals, thyroid, pituitary and pancreas in therapy, he dismissed the remainder of glandular therapy with this statement, "The theory on which many of these have been evolved shows little advance upon the belief of the savage that the courage of the lion may be acquired by eating the animal's heart, and the clinical observations which have been cited to support their use have generally been of an equally primitive character."

A perusal of some of the therapeutic fallacies of the past will tend to make a doubter of the reader, and he will wish to be shown. Not that we question the sincerity of those most active in promoting these fads; but logic was submerged by optimism. Many factors enter into the failure to observe therapeutic phenomena correctly. Only two will be considered, the psychology

of the sick, and the course of untreated disease.

The patient suffering from an acute or chronic disease prays for his recovery. In chronic diseases, as for instance chronic arthritis, even after years of treatment by both physicians and charlatans, he still hopes for the magic wand that will restore him to health. Here is a suitable soil upon which to sow the seeds of optimism. Psychotherapy, under whatsoever guise, is a powerful therapeutic agent. Often unconsciously administered, it becomes an unrecognized factor in the patient's recovery. Not a few of the misconceptions regarding the value of drug therapy are due to failure to recognize the rôle played by the personality of the physician and its influence on the patient. The good results of Weir Mitchell's rest cure treatment in nervous disorders were not due to the rest, but to the opportunity it gave the patient for daily contact with a personality such as Weir Mitchell's. Without the personality of the physician, the treatment would have been a failure.

My early years of practice were in association with a physician of unusual personality. When he was out of town, I was occasionally consulted by his patients. My untutored mind thought it always desirable to change a prescription at each visit of the patient. Not having undue confidence in myself, I usually repeated the prescription previously prescribed by my chief, simply changing the syrup so the patient might think he had something new. To my chagrin and enlightenment, such patients occasionally returned and requested the previous prescription, which had helped, while mine did no good.

You recall that, a few years ago, the theory was advanced that amebae were responsbile for pyorrhea, and emetin was used to destroy them. A few patients, sufferers from chronic arthritis, whom I had frequently seen over a period of years took up this new treatment. When they reported to me, they would say that the results of the treatment were little less than miraculous. When their joint findings were compared with those recorded at previous visits, it was apparent that the improvement was psychic and not real, and so it proved to be. Since then, it has been shown that emetin only affects the dysentery ameba and is not injurious to the ordinary innocuous parasitic type.

A few years ago, a colleague had in the hospital a large number of patients with arthritis. They were being treated by removal of foci of infection, followed by restorative measures, and were progressing nicely. The physician went on a vacation, leaving a younger man in charge. The progressive improvement ceased. The psychic stimulus had been withdrawn.

A good example of the beneficial action of faith is the curative influence of certain shrines. The grotto near Lourdes, where the Virgin Mary, in 1858, is reported to have revealed herself to a peasant girl, boasts of cures quite as remarkable as any obtained by the removal of tonsils or the extraction of teeth. It is fair to surmise that many of the cripples were sufferers from chronic arthritis, as reference is made to the casting aside of crutches and canes. The historian does not record how many of these cripples later regretted their rashness, as no doubt an

old crutch, like an old shoe, is more comfortable than a new one.

Before drawing conclusions regarding therapeutics in chronic diseases, it is advisable to keep the patient under observation until his enthusiasm has subsided, and reason is again in control.

A physician is not in a position to draw conclusions until he is thoroughly familiar with the course of untreated disease. The natural tendency of disease is toward recovery. If it were not, the world would either be depopulated or be inhabited by invalids. Lack of familiarity with the course of untreated disease is responsible for many errors in therapeusis. In the earlier years of practice, I was consulted by a patient in an advanced stage of pernicious anemia. He was advised to take increasing doses of solution of potassium arsenite (Fowler's solution). Three months later, he returned, miraculously improved. He related that he had taken one dose of the medicine, that it caused nausea, and he did not take any more; but his improvement dated from that day. He had experienced a spontaneous improvement, noted so frequently in this disease. If, in place of two drops of the solution, this patient had had a tooth extracted, the observer, if unaware of the course of the disease, might have been misled.

Those engaged in the practice of medicine before the days of focal infection recall that chronic arthritis did not necessarily pursue a progressively downward course. Recoveries were uncommon, but, not infrequently, a considerable degree of improvement was noted. True, it was as a rule temporary.

In order to avoid this source of error, it is advisable, or even essential, that, before drawing conclusions regarding therapeutics, we use controls, one series of patients receiving treatment, another series none. Provided this procedure is carefully safeguarded, valuable evidence may be obtained. The series must be large and carefully selected, and must be followed with the greatest care. Peculiar errors, which we ascribe to chance, may enter even here. Several years ago, we treated with quinin and urea all pneumonia patients coming on our service during a winter. Our results were then compared with those of the five other male services in the hospital. As patients were assigned by rotation, it would appear that this was a satisfactory method of using controls. During this period, we had eighty cases of pneumonia, all treated by this method. On the five control services, approximately 400 pneumonia patients received routine treatment. The mortality of the two groups, treated and untreated, was practically the same—22 and 21 per cent, respectively. In going over the records of services, one service was found in which the mortality was only 11 per cent. It is easy to see what might have happened, if, by chance, the patients on this particular service had been given the quinin and urea.

In spite of the considerable element of error which obtains even when the control method is conducted with care, the information obtained therefrom is the best available. It is a method which, in its application, offers great difficulties, and, for this reason, it is seldom adopted in therapeutic studies. This, in turn, accounts for the various therapeutic fallacies that have raised our hopes, but have finally led to disappointment. The method is much more readily applied to the acute infection, such as pneumonia, on account of the

rapid course and the short period required for the observations. Even in pneumonia, during the past decade, a few drugs and several serums have been rather widely heralded as promising considerable value in the treatment of this disease. As all of these have failed to live up to their early reputations, we can safely state that the originator of the method failed to apply properly the control method of study.

In chronic disease, the problem is much more difficult, as the observation must be carried on for a much longer period and the clinical course of this group is frequently extremely variable. The blood pressure in cases of hypertension, if followed for a period of a year, may, and usually does, show wide fluctuation. If cognizance is not taken of what occurs spontaneously, the investigator may be easily misled. Another point that must be borne in mind is the fact that an individual with a chronic disorder gradually accumulates a group of functional nervous disturbances. These are largely the result of self-study and apprehension. The relief from this group of functional symptoms explains the cures reported by Christian Science; those obtained from visiting a shrine and, we might add, those following certain operative procedures.

I have heard patients with chronic arthritis assert that they were temporarily greatly benefited by Christian science. Other patients with chronic nephritis have reported themselves cured by the same procedure. In the latter instance, an examination of the urine showed they were mistaken in their belief. In cases of subacute nephritis, I have seen patients in the same frame of mind, with just as little foundation, after removal of the tonsils or extraction of teeth. Even if the patient is a physician, he lays more stress on his feelings than he does on the urinary findings.

To discuss the pulpless tooth appears rather illogical and fruitless, unless we are first able to present definite evidence that focal infections in general are a menace to health. The evidence supporting this hypothesis is obtained in part from animal experimentation and in part from clinical results. Experience has shown that clinical results rather than animal experiments are the final test. A single example will serve to illustrate this point: It is possible to abort pneumonia in infected animals, but the same method applied to man is of no avail.

The presence of micro-organisms in a pulpless tooth or apical abscess is not evidence that this infection is responsible for pathologic changes elsewhere in the body. The usual method adopted for determining their pathogenicity to man is animal inoculation. The animal usually selected is the young rabbit. The adult rabbit is fairly resistant to infections; the young, highly susceptible. In all of this experimental work, relatively enormous doses of bouillon cultures are introduced intravenously. In a recent article on the dangers of pulpless teeth, the investigator injected 5 c.c. of a bouillon culture into a 1,500 gm. rabbit. This is equivalent to 250 c.c., or one-half pint, in a man weighing 160 pounds. While this dosage is above the average employed, rarely is less than 1 c.c. used, an equivalent to 50 c.c. or 1 2/3 ounces for man. When positive results are obtained in animals, the deduction is immediately reached that the source of this culture is a menace to its host. They have actually shown that a massive dose of

a certain micro-organism is capable of producing a pathologic lesion in a susceptible rabbit. The inference in regard to the host is wholly gratuitous. We have, in the pulpless tooth, an infection with relatively few bacteria, and the number entering the circulation at one time must, of necessity, be very limited. When one considers such experimental evidence carefully, he is remotely reminded of the Chinese physician's cure for shingles. The physician compares the vesicles that appear in this disease to berries. He draws on the skin about the involved area the outline of a plate. The berries thus appears to be on the plate. On the edge of the plate is drawn the head of a bird with open beak and alert eye. After a few days, the vesicles have disappeared. Circumstantial evidence convicts the bird of having eaten the berries, and incidentally cured the patient.

It is one of the recognized laws of bacteriology that one of the factors in infection is the number of the invading organisms. Protective inoculation in typhoid may be of no avail if massive numbers of bacteria are ingested. Another factor enters into this experiment: The rabbit has not been given an opportunity to develop an immunity gradually, as has the host who has harbored this infection for months or even years. Such animal experimentative work cannot, in any sense of the word, be accepted as evidence that the bacteria in an infected tooth is pathogenic to the host. A common laboratory method of increasing bacterial virulence is the passing of the culture through the animal. Bacterial invasion is not synonymous with bacterial infection. Pneumococci may frequently be obtained in cultures from throat swabs of healthy people. These cultures will kill white mice, but we do not immediately conclude that such an individual is in danger of developing pneumonia. In fact, it has been shown that these pneumococci are largely innocuous to man. Experimental evidence, to be of value, should first determine whether the host is susceptible to the bacteria he has been harboring for months or years. If so, the animal inoculation should be conducted in a manner analogous to that occurring in the host, minute doses of the bacteria being administered at frequent intervals. In addition, it would be necessary to determine the relative susceptibility of the host and the rabbit.

Passing now to the clinical evidence: what benefits have been derived from the removal of foci of infection? Discussion of this phase of the subject offers great difficulties. At present, it appears impossible to answer this question in either the affirmative or the negative. No attempt will be made to consider all of the diseases in which focal infections have been held responsible and for which tonsils have been removed and teeth extracted. The discussion will be limited to arthritis, the disease that has attracted most attention from the standpoint of focal infection. The deductions drawn, however, apply equally well to other diseases.

Acute arthritis is generally considered as originating in the throat, especially in the tonsils. The clinical history of a preceding sore throat lends support to this view. Recently, Drs. Ingerman and Wilson[1] studied the effect of ton-

1. Ingerman, E., and Wilson, M. G.: Rheumatism; Its Manifestations in Childhood Today; Tonsillectomy in Its Relation to Recurrence of Rheumatism, J.A.M.A., 82: 759 (March 8) 1924.

sillectomy in the recurrent arthritis of children. Some children are subject to recurrent attacks of acute arthritis. A group of 185 children with this trouble were observed. The tonsils were removed in eighty-eight and were unmolested in ninety-seven. The cases were then followed up for a period of from one to eleven years. Seventy-six per cent of those who underwent tonsillectomy and 80 per cent of the controls had further attacks of acute arthritis. G. H. Hunt,[2] in a study conducted along much the same lines, arrived at the same conclusion. These results should not be accepted as conclusive, and yet they supply us with valuable evidence that removal of tonsils does not prevent acute arthritis.

Untreated chronic arthritis pursues a very variable course. A small percentage of cases progress rapidly to complete disability. The majority are not noticeably progressive, but are frequently characterized by periods of marked improvement followed by recurrences. At the end of twenty years, the patients are not necessarily more disabled than they were ten years previously. Many of the milder types of the disease never involve more than a few joints. Complete recovery, in the sense of full restoration of function, rarely, if ever, occurs in well established cases of chronic arthritis. Frequently, discomfort is due to a pressure neuritis, secondary to osteo-arthritis of the spine. As the osteophytes responsible for the pressure are permanent, the source of the pain remains, even if the infection is removed. When a patient with neuritis of this character states, soon after the extraction of a tooth or removal of the tonsils, that he is greatly relieved, we are not justified in concluding that the operative procedures were responsible for it. Knowing the underlying pathologic conditions, this appears impossible. The improvement is probably spontaneous, and careful questioning will usually reveal that periods of comfort have marked the past. In drawing conclusions in regard to the value of removal of foci, it is most important that we be familiar with the course of the untreated disease and the influence of the psychology of optimism. With the exception of the rapidly progressive type, it is probably impossible to predict in the early stages the course of a chronic arthritis.

When we set out to study the truth of a theory, we first peruse the literature and analyze the evidence there presented. To cover all, or even a small part, of the literature on focal infections is a real task. In the "Cumulative Index to Medical Literature," in 1924, forty-eight articles were listed under the heading "focal infection." Forty-seven of these were published in American journals and one appeared in an Australian journal. No articles were listed from the continent of Europe or the British Isles. Although focal infection is a lusty and, I might say, a noisy youth of 15 summers, interest in the subject is largely confined to the country of its birth. This has only a limited significance, as it can be equally well interpreted as an American discovery or an American fallacy. A widespread acceptance should, however, be a source of encouragement to its supporters.

A study of the numerous case reports is far from convincing. The course of the disease after removal of the foci may be rather unusual. Perhaps you

2. Hunt, G. H., and Osman, A. A.: Guy's Hosp. Rep., 73: 383 (Oct.) 1923.

can recall cases which, without special treatment, follow the same course. Usually, the patient's statement is accepted as evidence, without confirmation by physical examination, and often without special effort to determine whether, in the past, he has enjoyed like periods of improvement. Control series adequate in number and properly safeguarded, to the best of my knowledge, cannot be found in the literature. In addition to the current literature, a two volume treatise has been perused, in the hope of finding evidence from which to draw conclusions. I was unable to detect any close relationship between the evidence presented and the conclusions drawn therefrom.

As in other therapeutic procedures, the only acceptable evidence is comparative studies with untreated controls. Nothing else meets the requirements. There is no substitute. To meet this requirement, it would be necessary to select two series of cases, each consisting of several hundred individuals. They should be so selected that the character of cases in the two groups resemble each other closely. In one series, all suspicious foci should be removed; in the other, they should be undisturbed. Each patient should be examined annually for a period of five years, and the findings carefully recorded. The summation of these findings, provided the improvement in the treated series was definitely greater than in the untreated, would be acceptable evidence that removal of foci was beneficial in arthritis. To prove that the pulpless tooth was a factor, it would be necessary to take a second series and remove only the pulpless teeth. To prove by the control method that focal infections as a whole are factors in chronic arthritis is an almost impossible undertaking. Truly, "the search for truth is difficult and laborious." To prove by this method that the pulpless tooth is a factor, while not entirely impossible, is a task no one would care to undertake. It is for this reason that I have not adhered in the discussion to the assigned title. The difficulty of using the control method is so great that rarely do we find an individual with the facilities and the patience to apply it; and this accounts for the numerous therapeutic fallacies that have crept into medicine in the past. When we glance through the therapeutic measures of the past, we find that those supported by proper controls have stood the test of time and have become an integral part of medicine. The theory as to their method of action may have been wrong, but the results obtained survived.

A classic, and, at the same time, one of the earliest demonstrations of the control method, was that employed by Pasteur in the use of his protective serum in anthrax. A series of animals were inoculated with anthrax, and half of them at the time of inoculation received a protective serum. Those protected lived; the others died. Another beautiful example of the value of the control method in arriving at the truth is to be found in Edward Jenner's small monograph on the protective value of vaccination in smallpox. In the preface appears the following: "Finding the prevailing notions on this subject both among men of our profession and others extremely vague, and conceiving that facts might appear at once both curious and useful, I have instituted as strict an inquiry into the causes and effects of this singular malady as local circumstances would admit." A modest statement, but full to overflow-

ing with the spirit of truth. There follows a series of only twenty-three cases in which he has tried his protective inoculation—a perilously small number upon which to prove a theory or base a conclusion. Control cases had been selected with such care, in such an unbiased manner, that the student of medicine of that day must have been convinced that a great discovery had been made, and that time would verify it.

In the control method of studying arthritis, reference has been made to a series of a hundred or more cases. A much smaller series would serve the purpose. The selection of even a small series would be almost impossible today. In the past five years, every patient seen with chronic arthritis has already had many or all of the teeth extracted. It would be most difficult to muster even a moderate number of controls, unless we seek some isolated hamlets. As this method is not available, we must select the only other method—tedious as it may be—the test of time.

The question arises: Is there not other means by which we can arrive at fairly accurate conclusions, or at least something that will give a slight clue as to whether we are on the right road? We have a few rather large series of cases of chronic arthritis treated by removal of foci. Some of these have been quite carefully followed, and a serious effort has been made to determine the outcome. We may select as an example of such a series that of one of the early investigators. From 1905 to 1915, he treated 411 cases of chronic arthritis. In 1921, a questionnaire was sent to each patient. Replies were received from 226. The number improved and those unimproved is reported. The sole conclusion to be drawn is that, by a method of treatment which included removal of foci, use of vaccines, hydrotherapy and physiotherapy, dietary regulation and advice in regard to future mode of life, a certain number of patients improved. These results are interesting, but they do not actually prove that anything was accomplished, as no check was made with a control series. If such controls had been used and the results favored the treated series, the question would still be undetermined as to which of the various agencies used in the treatment was responsible for the improvement.

As the animal experimental work is open to severe criticism and the clinical observations are not suitably controlled, it becomes necessary to investigate another type of information, much less scientific yet possessing some value. I refer to what is commonly known as impression. Man's impressions are simply a general idea that certain things are true. They are not arrived at by a careful analysis of collected observations and are, therefore, of only limited value, and may easily be confused with facts. Impressions are a nonstandardized mixture of grain and chaff. The winnowing of time determines the amount of each of these components. Their truth or fallacy must be determined by more accurate methods. It may be of interest, however, to discuss the impression of the dental and medical professions on the importance of focal infections in disease.

I am not in a position to discuss the attitude of the dental profession, except in the most superficial manner, and with the limited experience of a few personal observations. It is clear that there is by no means a unanimity of opinion on this important question. It ranges from an attitude of skepticism

on the importance of the apical abscess and strong opposition to the extraction of the pulpless tooth, to the occasional individual who considers a leukocytosis adequate evidence of active apical infection, and acts accordingly. This last statement is not an exaggeration, and it is striking evidence of a lack of thought approaching fanaticism.

When the impressions of the medical profession are analyzed, we find here, also, a marked difference of opinion. A goodly number of physicians never experienced an early enthusiasm. With few exceptions, those who hoped in the beginning that a real panacea was in sight are now lukewarm or even skeptical. An occasional physician is still enthusiastic. It is significant that a method of treatment in vogue for more than a decade should be losing rather than gaining adherents. If we may judge from the history of previous therapeutic ventures, this is an ominous sign. As far as I am concerned, chronic arthritis, and I might include other chronic conditions thought to be due to focal infection, is just as much a problem today as it was before the days of focal infections. This frame of mind has been reached after a rather extensive experience. It is possible that our conception of focal infection in disease should be modified. Perhaps our attention has been centered too closely on circumscribed foci, overlooking the nasopharynx with its islands of lymph tissue and the structures in the posterior nares, where it has been shown that bacteria readily invade the tissues and thus gain access to the circulation. This is the supposed route of infection taken by the meningococcus and the hypothetical micro-organism of poliomeylitis. The frequency with which an acute exacerbation in chronic arthritis follows a nasopharyngeal infection adds some support to this view.

There may be some who believe that the failure to obtain satisfactory clinical results is due to nonrecognition of the importance of the pulpless tooth. It is scarcely probable that the pulpless tooth is the sole focus responsible for generalized infection. There are others who might claim that extraction of the pulpless tooth should be performed as a preventive measure. The burden of proof that such a tooth is a menace rests on those who take this position. The ruthless removal of a useful organ for the purpose of preventing a possible future calamity, unless based on adequate evidence, should not be tolerated. Such evidence, to the best of my knowledge, does not exist. Both physicans and laymen would rise in protest if surgeons should advise the removal of all gallbladders and appendixes, as they might be a source of infection. Except for the danger attendant on the procedures, the two suggestions are comparable.

It requires some courage to stand with folded arms and do nothing for the chronic invalid, except to give such advice and encouragement as we think may be helpful. Let us believe that we will have fewer regrets and our reputation be enhanced if, for the present, we remain merely intent observers. The advice given by Sir Thomas Sydenham, a famous clinician of the seventeenth century, is still applicable: "Whenever I find that from the medicine which I have thought fit to use I am unable to give the patient reason to expect any definite benefit, I do no more than my duty as an honest, conscientious physician when I just do nothing at all."

THE PROBLEM OF THE PULPLESS TOOTH AS SEEN BY THE GENERAL PRACTITIONER OF DENTISTRY*

By C. N. JOHNSON, M.A., D.D.S., Chicago, Illinois

IT would seem to be quite appropriate that at last the general practitioner of dentistry should be called on for his views on this most important subject. Heretofore, the disposition of the pulpless tooth has been placed largely in the hands of two classes of men, neither of whom may be considered wholly qualified to decide upon it—the practitioner of medicine, and the specialist in dentistry. No reflection is hereby made on either class; but it is at least pertinent to remark that the average medical man knows less about the teeth than the average dentist, and that the specialist in radiography and exodontia, in his concentration on this one subject, would be something more than human if he did not fall into the habit of "seeing things." And it may be remarked parenthetically that some of the things he sees are not there. For instance, in the early days of radiography, it was quite common for such terms as "abscess," "infection" and kindred words to be written all over films with the utmost abandon, and to the consternation of the patient. Now, happily, such terms have been largely eliminated from the diagrams of roentgen-ray operators, simply because the capable and conscientious men in radiography soon learned that it was quite impossible to tell by a film whether an abscess was present or not. And let it be said in this connection that the chief agent by whom this conviction was forced on our roentgen-ray operators was the general practitioner. It was largely his protest that led to the elimination of these terrifying terms, and today there is gradually developing a better understanding between all parties concerned, and consequently a better service to the patient.

The position of the general practitioner has not always been an easy one. If he has been painstaking in his work, has had an extensive experience over a long period, and has carefully observed his operations year after year, he has naturally grown into the conscientious conviction that he has been rendering worthy service to his patients. All has been going well with the mouth and teeth, with no complaint of pain or trouble. There has developed between the patient and himself an *entente cordiale* which has gone a long way toward making professional life worth living, and which has contributed in large measure to that deep personal interest which every professional man should take in those whom he serves. But, one day, his patient, through some indiscretion in diet or through undue exposure, develops a pain in the shoulder, or leg, or back or foot—it matters not where—and goes to the physician. It is then that real trouble for the general practitioner and the patient begins. It is only a statement of fact *a priori* to say that medical men, in common with all other professional men, are given to fads. There seems to be an uncontrol-

*Read before the Midwinter Clinic of the Chicago Dental Society, Jan. 27, 1926.

lable tendency in human nature, particularly in that portion of human nature which has to do with the healing of disease, to run off on a tangent on any idea which has new or novel features, and to pursue this idea to an altogether illogical conclusion. It is no reflection on the medical profession to make this statement, and there is no intent to single out medical men as the sole transgressors. Dentists are as much given to fads in practice as are any other men, and in passing it may be remarked that their patients have sometimes suffered as a consequence.

For the past few years, there has been an altogether undue concentration on the teeth as causative factors in disease, to the end that the general practitioner of dentistry has had the very life harried out of him, and has seen more injustice done to people than can ever be atoned for by either physicians or dentists.

It has become the prevalent practice with many physicians to at once charge the teeth with all the ailments of humanity without being broad enough to look farther for possible trouble in other organs. To use the vernacular of the street, the teeth have been an "easy mark" for the rank and file of medical men. Two typical cases of recent experience will serve to illustrate just what is going on daily. A woman strained her hip and was somewhat lame. She consulted a practitioner for relief. Without asking the cause of her lameness, he immediately said: "Have you any dead teeth?" She asked what he meant by dead teeth. He replied, "Crowned teeth—have you any crowns in your mouth?" She said she had quite a number. "Then," said he, "that is the cause of your lameness—we need go no further." The patient protested that the crowns had been on a long time without giving the slightest trouble; that they had been placed there by a painstaking operator, who repeatedly checked up his work by frequent roentgen-ray examinations as he went along, and that she felt confident the crowned teeth were not causing the present trouble, which was due to a strain. "Madam," he remarked dramatically, "Do you realize that every one of those teeth has *seven miles* of canals running through it, and do you suppose it is ever possible to sterilize all those canals?"

With the average patient, such a remark as that by a medical man would have been more or less terrifying, and would have produced a very unfortunate psychologic effect; but, fortunately, this particular patient had the good sense to pay this man his bill immediately and walk out of his office. In a few days, her hip was well, without treatment.

Another most inexplicable case came to notice within the past few weeks, a case that has puzzled the general practitioner more than a little. A lady had some intestinal trouble which had been apparent for years, and, on this particular occasion, she had not been feeling well for a few days. There was no discomfort of any kind, but an apparent lack of energy, or listlessness, which drove her to a physician for consultation. His first question was, "How are your teeth?"— a not unusual procedure with medical men of the day. She informed him that she thought her teeth were in excellent condition. "Let me see your mouth," he remarked, and the moment he glanced at her teeth he exclaimed, "Ha! *pus*! Here is the cause of your trouble. Go and have some X-rays made imme-

diately." This somewhat startled the patient, but instead of going to the radiographer recommended by the physician, she went direct to the office of her dentist, saying that she had been somewhat frightened and a good deal insulted by being told that her gums were full of pus. This woman had always given the most scrupulous care to her teeth, and such a remark as this puzzled the dentist; so it may be taken for granted that the subsequent examination was undertaken with the greatest care. After a most thorough inspection, it was found that the entire mouth was in a sanitary and perfect condition, with not a trace of pus nor the least congestion of the gum tissue. It was a mouth that was unusual in normality, and always had been, and the dilemma at this moment is to account for the remark of the medical examiner. Possibly a little emulsified food had been seen clinging to the surface of a tooth, and was carelessly identified as pus—a mistake that is evidently sometimes made.

Let it not be thought that these are isolated cases. The general practitioner encounters such cases almost daily, and the net result is that his professional life is made a burden, and he goes to his home at night depressed and despondent over the false ideas that are implanted in the minds of patients, and the irreparable damage that is done to them not only physically but also psychologically. Too frequently, patients who really have merely some minor ailment, which would be relieved by a simple common sense regulation of their habits of life, are made to feel that they are seriously ill of some grave malady, and that this malady is due to the teeth. And when there actually is a serious illness, the tendency of the day is to concentrate on the condition of the teeth as the cause rather than to look to other possible agencies; with the net result that countless thousands of harmless and useful teeth have been sacrificed on the altar of this fetish. There has in the history of medicine or dentistry seldom been such an exhibition of professional aberration as has been evinced in recent years over this question of the teeth. And the end is not yet. When we witness such cases as have just been recited, and see them repeated almost daily in the experience of the general practitioner, it must "give us pause" and make us wonder when this folly shall cease. Too many people today are going around minus useful teeth and needlessly crippled for life as far as effective mastication is concerned, because of this undue concentration on the teeth, and it so chances that most of these mistakes fall under the observation of the general practitioner. He is constantly placed in a dilemma to know what to do for his patient in the way of restoration after the medical man has cavalierly ordered the removal of several teeth on the mere suspicion that they might be causing trouble, and too frequently the mouth has been left in such condition after the extraction of a few suspected teeth that the attempt to furnish the necessary artificial substitutes inevitably places the remaining teeth in a position to do possibly greater damage than was done by the teeth that were so routinely removed. But this problem is one that never apparently concerns the medical man or dental specialist, simply because it is not their problem. They argue that if a tooth is the cause of systemic trouble, it should be removed regardless of any other consideration, and this argument would be a valid one provided it were possible for us to determine

definitely that a tooth was causing trouble. But this with our present knowledge, or rather with our present limitation of knowledge, we are not able to do. We extract teeth today simply on suspicion, a perfectly legitimate procedure provided all the other possible sources of trouble are investigated and found negative. But to follow the routine procedure of extracting teeth first and looking for other trouble later is all wrong.

We shall proceed more intelligently in these matters when the time comes, if it ever does, that we are able to determine by a bacterial examination whether a given infection is caused by the teeth or arises from some other source. It has been claimed that this determination may be made, but up to the present time there is so little that has been definitely established in this direction that we are still at sea in trying to trace the sources of infection. And while we are thus admittedly at sea, is it not more logical to try to run down every possible source of infection first instead of summarily charging the teeth with every conceivable ill and ordering their extraction at once?

These clinical facts stare us constantly in the face, and they really should be reckoned with: there are countless cases in which the teeth have been removed without the slightest amelioration of the systemic symptoms, and there are as many more cases in which the systemic trouble has entirely subsided and the teeth were retained, pulpless teeth as well as others. There seems to be a serious discrepancy between the findings of the specialist and of the general practitioner in this regard, and possibly there is a reason for this apparent discrepancy which should be considered by both parties. The general practitioner should remember that the specialist naturally comes in contact with the gravest and most desperate cases of infection, cases that call for radical and heroic measures in the attempt to eliminate the trouble. No one of any sanity would argue for the retention of a doubtful tooth when the systemic symptoms are gravely serious, and other possible sources have been investigated and found negative. A tooth is not so important as a life, and we should not be hidebound either way. But, on the other hand, the specialist should recognize the patent fact that there are other agencies of disease aside from the teeth, and that to ignore that fact is to do a grievous injustice to the patient. The medical man, the dental specialist and the people should be brought to recognize this one thing: in the recent past, the teeth have been charged with doing an infinitely greater amount of damage than they are guilty of. There is nothing in all human experience more certain than this, and the prediction is here made, with the utmost confidence, that this fact will be demonstrated beyond any possible doubt both clinically and experimentally in the near future.

Much of the propaganda against pulpless teeth has been worked up on insufficient evidence. Many of the so-called cures resulting from the extraction of teeth have turned out not to be cures at all. A temporary amelioration of the symptoms, probably due as much as anything else to purely psychologic reasons, has been heralded as a positive demonstration in favor of the elimination of the teeth; only to be followed by a recurrence of systemic symptoms as severe as ever. A typical case might be mentioned. A woman was suffering from rheumatism, and

all her teeth were extracted in the effort to cure her. There was at once a cessation of the symptoms, and the case was quite extensively exploited as a demonstration of the value of tooth removal. In six weeks, her rheumatism was as active as before, and the case had to be recorded as one more pathetic failure to discover and eliminate the source of the trouble. Too many useful teeth have been thus sacrificed without the slightest benefit, and with irreparable damage to the patient, to permit this practice to go on without protest. Much of the so-called scientific demonstration of the evils of pulpless teeth, many of the weird pictures that have been thrown on the screen, and many of the data given in formidable arrays of figures and tables are inconclusive and misleading. They have clouded the issue, and biased the profession, and, worse than all, they have terrified both the practitioner and the patient into an altogether unreasonable attitude toward the question of pulpless teeth. The psychologic effect of much of this propaganda against the pulpless tooth has been demoralizing and disastrous. People who have never been seriously ill in their lives have been made apprehensive of their condition, and have worried themselves into ill health and unhappiness as the result of being told that they have poison lurking about the roots of pulpless teeth. To gaze at these mysterious figures, many of which are not sustained by the logic of facts, and to listen to these terrifying tales is enough to make a well person feel ill; and when this kind of seed is planted in the minds of certain imaginative individuals, the result is pathetic, and sometimes pernicious. And much of this psychologic aberration comes under the notice of the general practitioner. In contradistinction to the specialist who sees the patient who has a grave case of real illness, he encounters very many people who have no tangible or organic trouble, but who become a burden to themselves and to others by a constant harping on imaginary ills, and who interpret every little ache or pain as a symptom of some serious disorder. These are the individuals who really seem to enjoy poor health, and they are a fruitful field for the dental alarmist. If you plant in the mind of an individual of this type the idea that there is poison coming from the root of a tooth, there is no peace in that family till the tooth is removed. And then, a little later, when the individual has had this process repeated several times, he begins to pester some other practitioner to have artificial substitutes inserted because of the difficulty of masticating his food; with the net result that the last condition of the patient is worse than the first.

There needs to be and there must be a better understanding among all of those who are charged with the welfare of the people as far as their dental ills are concerned. There is so much confusion today on the subject of pulpless teeth that the sane and reasonable patient is often in a dilemma to know what to do. There is such a disagreement between professional men that the patient is left to wonder whether or not any of them know anything, and this is not conducive to a proper understanding between the people and the professions. Much of this, of course, is due to our human limitations, and it is too much to expect that we shall all see these things in the same light, but we can at least proceed on a more rational basis than we have been doing in the past few years. We should each give

the other credit for honesty of purpose, but we should frankly and boldly contend for what we deem to be the welfare of the patients. Frequent conference and continued study of these questions are necessary to bring us to anything like a unanimity of opinion in judging the status of the pulpless tooth; and at this point it may seem appropriate to claim that, when this subject has finally been reduced to a stable basis, the experience and influence of the general practitioner will be as largely responsible for the fact as any other single agency. Specialists in medicine and dentistry are necessary and of immense value in professional progress, but it would not do to turn all of humanity over to their tender mercies.

DISCUSSION

Arthur D. Black, Chicago, Ill.: The papers by Dr. Miller and Dr. Johnson represent the best thought in the two professions on this important subject of focal infections. Dr. Miller has presented a careful analysis of the situation and has shown us how difficult it is to know definitely the exact relation of the original focus to the supposedly secondary infection. There are gathered in this hotel several thousands of the most progressive dentists of America to take part in a splendid program covering almost every phase of practice. I recognize the value of this program in its various aspects, yet I could not help thinking, while Dr. Miller was reading his paper, that the total result of this meeting, in betterment of service, might be greater if there had been nothing on the program but Dr. Miller's paper. I will confine my discussion very largely to a review of certain phases of the laboratory studies which have been made to determine the relation of the original focus to the so-called secondary lesion. Years ago, Rosenow demonstrated the same organism in both lesions and inoculated animals with cultures from each, and there occurred in the animals a high percentage of lesions similar to the "secondary lesion" in the person from whom the cultures were made. It was generally believed that these experiments proved that the "primary focus" was the cause of the "secondary lesion." Rosenow's deductions as to the "selective affinity" of different strains of streptococci for particular organs or tissues were based on several extended series of such experiments. The accuracy of Rosenow's work cannot be questioned, but we might suggest other deductions which would as satisfactorily explain the findings. Is it not probable that, regardless of the location of the original seat of infection, the organisms found in the area about the tooth are likely to be the same as those cultured from the secondary lesion, because the secondary lesion becomes the predominating lesion, throwing a sufficient number of organisms into the circulation to displace those in other infected areas, including the area about the tooth? There would be no difference in the findings, as far as the area about the tooth is concerned, if the original focus had been in the tonsil or elsewhere. I am just raising the question as to whether it is fully proved that similar cultures from the tooth area and the "secondary lesion" really prove the tooth area to be the original focus and the cause of the secondary lesion. May not the infection in the tooth area, in a percentage of cases, be secondary to the other lesion?

Practically all animal inoculations from infected areas in the mouth appear to have been from persons having secondary lesions. Only very limited studies have been made of the pathogenicity of cultures obtained from mouth areas of persons having no discoverable secondary lesions. Most of the studies so far reported are of persons who are sick—hospital cases. What would be the findings in a series of cases of persons who are apparently well, except for the presence of an infected area about a tooth? During the past year cultures have been made in the research department at Northwestern University from a considerable number of cases and inoculated animals have generally shown little reaction. These experiments are as yet too limited, but they suggest that infected areas about the tooth may not be so great a menace to health as many have believed. Ten years ago, this whole problem looked rather simple: an infected area about a tooth, the same organism in a joint, cultures from each producing like lesions in animals: extract the tooth and cure the rheumatism. The accumulated studies of many laboratory investigators and clinicians now show that the problem is extremely com-

plex, so that our best men are now more cautious in their statements and more conservative in the extraction of teeth. All except the most radical have become wise enough to make no promises when abscessed teeth are extracted.

Thomas L. Gilmer, Chicago, Ill.: I hope that Dr. Miller's paper will help to stem the tide of ruthless extraction of teeth that is sweeping over this country. Infections in the jaws, like infections elsewhere in the body, should be eliminated, but most people have infections of much greater extent in other parts of the body, which are a greater danger to the patient than are those infinitesmal apical thickenings about some of the teeth. We know that many of the so-called granulomas about the apices of the roots of teeth are not infected; that they are often encapsulated and are largely composed of normal granulations, and are therefore of little danger to the host. As a rule, curettement of tooth sockets is wholly unnecessary and unwarranted. I have proved this by examining many thousand radiograms of edentulous or partly edentulous jaws in which curettement had not been done, and in only a very few instances have I found any radiolucent zones remaining, and where such zones were found, they proved to be small innocuous cysts. There are zones of greater or less density in parts of all jaws, even in those which never have been infected. Such zones may be mistaken for areas of infection. The efficiency of artificial teeth for mastication is far below that of the human denture. Gysi's experiments show that they are only 12 per cent efficient. Perhaps this slightly underestimates the masticating value of the best artificial teeth, but their efficiency is far below normal. Artificial teeth, like artificial limbs, are a blessing, but are not to be compared with good natural teeth or limbs. We know that thorough disinfection of root canals and infected zones beyond, followed by good root canal fillings, usually makes teeth safe. Let us keep our feet on the ground and not be carried away because some one attributes the high death rate from cardiac disease in two certain cities to treatment and retention of pulpless teeth in the jaws, and the low death rate from the same disease in another city to the removal of all pulpless teeth. The so-called surgical removal of teeth is wholly unnecessary and often damaging. We have always removed sharp edges of the alveolar process when present or when there was overfullness in the anterior part of the jaw. The latter may often be best done after the healing, following extraction, especially if there is infection. The so-called surgical removal of teeth and curettement of tooth sockets is done, either through lack of information regarding the necessities or for spectacular reasons or, worse, commercial. Dentists and physicians have gone far beyond what my collaborators or I dreamed of advocating, and our further studies of the subject have demonstrated that our original conclusions went further than was justifiable. I feel that I am somewhat in the predicament of the farmer who yoked himself up with a young steer to accustom it to the yoke. After training the calf for a few days he ventured out of the barnyard onto the road, yoked to the calf, which ran away with him. As they ran down the road he saw one of his neighbors approaching and exclaimed, "Head us off." Since I was one of the first to do research in connection with jaw infections and have continued this work up to the present and see the results now prevailing, I am inclined, with the farmer, to exclaim "Head us off."

BALANCED OCCLUSION—ITS PRACTICAL APPLICATION IN PARTIAL DENTURE CONSTRUCTION*

By ARTHUR PAUL LITTLE, D.D.S., St. Paul, Minnesota

THE term balanced occlusion has to do, not merely with tooth interdigitation, but with a perfect relationship and coordination of all parts dependent on or controlled by the teeth themselves.

To have perfect relationship and perfect coordination of all parts would be to have an ideal. The ideal is that which exists only in imagination. However, in many of the sciences, it is necessary that we use the ideal as a standard of measure in making our deductions. In the study of balanced occlusion, we lay our foundation or basis on the ideal human denture.

This means that every part of the base of the cranium on which the occlusion exerts an influence must be given consideration, and a knowledge of the physiologic functions of these parts is essential for the fullest appreciation of their importance. At no period in life does the relative significance of this guiding factor in the maintenance of health and efficiency in the dental apparatus decrease. In infancy and childhood and throughout adult life, the condition of the occlusion denotes the state of health of the mouth and its tributary parts. With a hope that the knowledge gained will act as a guiding influence in our restorative work, let us briefly analyze the points in the ideal human denture that are of interest in a consideration of balanced occlusion.

Every part of the human body reaches a certain height of development as a result of the physical forces to which it is subjected. The anatomic structures of the head and neck are developed to their maximum functional efficiency largely through the developmental influence of the natural teeth. When this process goes on undisturbed, the result is a perfect coordination of all parts. This means that there will be established a certain definite relationship between the mandible and maxillae. As long as this relationship remains undisturbed, the mandible and maxillae serve as proper support for the attached anatomic structures. It is obvious, then, that one of the chief functions of the teeth is to preserve this condition.

Physiology teaches that, in order to have muscles function properly, the distance between the origin and insertion must remain constant. A common example of the failure to obey this law is seen in the limbs when, from injury or disease, the linear dimension is lessened, and only partial function remains. We see not only a diminution in the normal activities but also atrophy, in proportion to the interference.

The maximum efficiency in the functions of mastication, deglutition,

*Read before the Section on Partial Denture Prosthesis of the American Dental Association, Louisville, Ky., Sept. 22, 1925.

respiration, drainage of the oral cavity and posterior part of the pharynx, equalization of air pressure in the middle ear

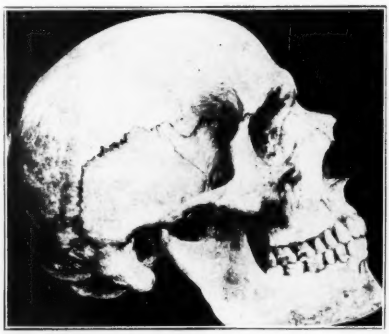


Fig. 1.—Skull showing that the teeth are the sole means of maintaining a definite balance between the mandible and maxillae.

through the eustachian tube, and supply of blood to these parts are directly or indirectly dependent on the maintenance of the occlusion.

The accompanying group of illus-

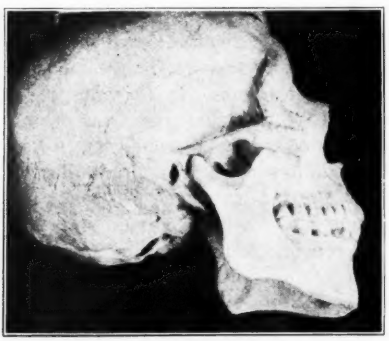


Fig. 2.—Skull showing space occupied by the meniscus or fibrocartilage.

trations will be an aid in visualizing the responsibility that good occlusion has toward the proper functioning of the human dental apparatus.

Figure 1 shows a well developed skull in which it is clearly evident not only that the teeth bear a definite relationship to each other, but also that they are the sole means of maintaining a definite balance between the mandible and maxillae.

In Figure 2, your attention is directed to the space occupied by the meniscus or

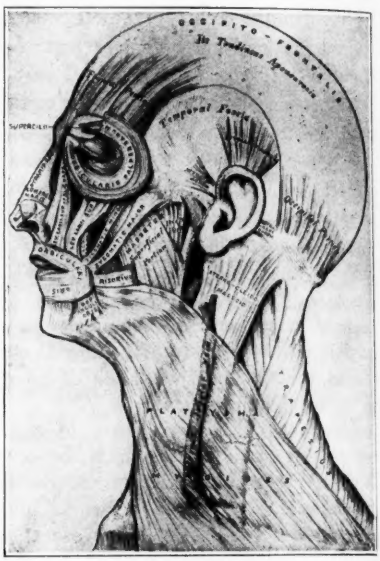


Fig. 3.—Muscles of expression.

fibrocartilage. It is one of the functions of the occlusion to preserve this space and avoid traumatism that may arise in the temporomandibular joint.[1] When the occlusion is disturbed the condyle produces pressure on the meniscus. This sometimes goes as far as to cause an irreparable injury.

1. Prentiss, H. J.: A Preliminary Report upon the Temporomandibular Articulation in the Human Type, Dent. Cosmos, 60: 505 (June) 1918.

Figure 3 shows the superficial structures of the head, face and neck. In this group will be found the muscles of expression. To avoid that atrophic appearance so often seen in the face and commonly accepted as due to old age, it will be necessary that the origin and insertion of these muscles remain constant. As these muscles are directly or indirectly attached to the mandible and maxillae, it is apparent that, if their developmental dimension is to be maintained, it is necessary to maintain the proper distance between the mandible and maxillae.

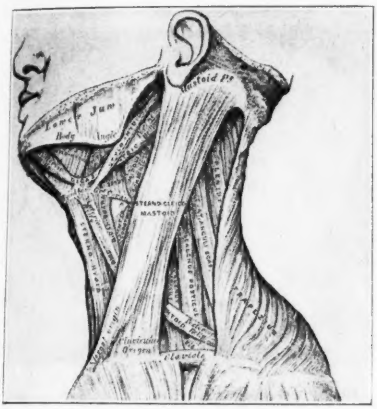


Fig. 4.—Muscles of neck and throat.

Figure 4 shows the muscles of the neck and throat. As many of these structures are directly attached to the mandible, their functional efficiency will be at its best when there is no relative change from its original position. The natural teeth, or satisfactory substitutes, are the only means of maintaining this original position of the mandible.

Figure 5, a cross-section prepared by Dr. Lischer, through the sagittal plane of the head, shows the correct position of the tongue and the relationship it bears to the surrounding structures. Note the amount of space in the nasopharynx. In event of a closure of the bite, it is easy to see how the tongue will be crowded back into the throat space and act to diminish its functions and those of the tributary parts.

If the only means of maintaining a balance is the teeth, it becomes necessary, when restoring balance to the broken down arches, to have some knowledge both individually and collectively of Nature's method of arranging them in the ideal human denture. A study of this arrangement gives an explanation of what is necessary for efficiency, and a better understanding of the disadvantages under which teeth are forced to operate when there is not a correlation of all the parts and the adjacent structures.

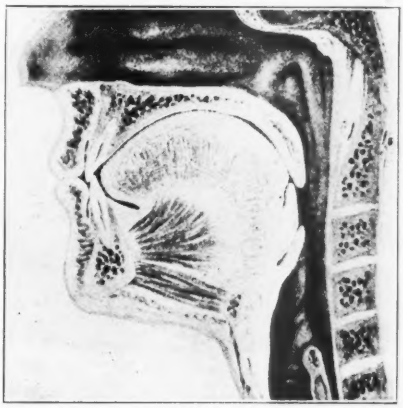


Fig. 5.—Cross-section through the saggital plane showing the correct position of the tongue and the relationship it bears to surrounding structures. (Lischer.)

It is now an established fact that the human mandible in its various movements from central occlusion with the teeth in occlusal contact describes a series of arcs. This was one of the contributions made by Dr. Monson in his early research work. Hence the term spherical occlusion arose.[2] He found that, in the higher types of development, the occlusal surfaces of the teeth and the center of the condyles conform to the surfaces of a sphere whose diameter is approximately 8 inches; also, that the long axis of the teeth when projected passed through the center of this sphere.

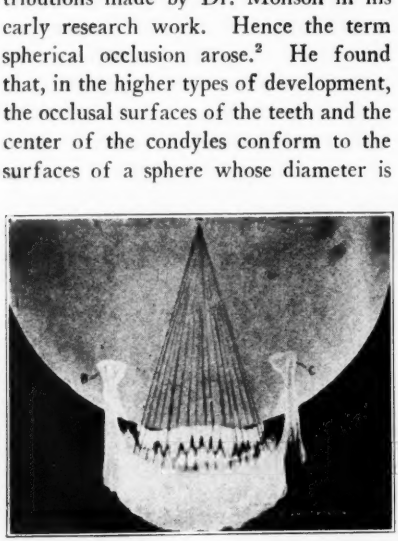


Fig. 6.—Anterior view of 8-inch sphere applied directly to mandible. (Monson.)

For the purpose of explaining the spherical theory in a simple manner, Dr. Monson made use of the 8 inch sphere applied directly to the mandible. We see here (Fig. 6), the application of the sphere from a front view. Note the conformity of the teeth to the surface; also that lines drawn from the center pass through the long axis of the teeth.

2. Monson, G. S.: Occlusion as Applied to Crown and Bridgework, J.N.D.A., 7: 399 (May) 1920.

Figure 7, the posterior view of the sphere applied to the mandible, shows the center of the condyles conforming to the surface of the sphere. The radial dimension from the center of the sphere is common to the condyle and all of the teeth. Thus, we see that the radial center is the center of applied force in our mechanism of mastication.

It is true that the ideal human denture is somewhat visionary; but the knowledge gained in studying the highest types of development better enables us to analyze the specific needs in each individual case that we meet in practice. Do not get the impression that every human dental apparatus can be brought back to the high type of efficiency found in the ideal. We do, however, recognize in each individual a certain height of development that becomes the goal toward which we strive when attempting to restore.

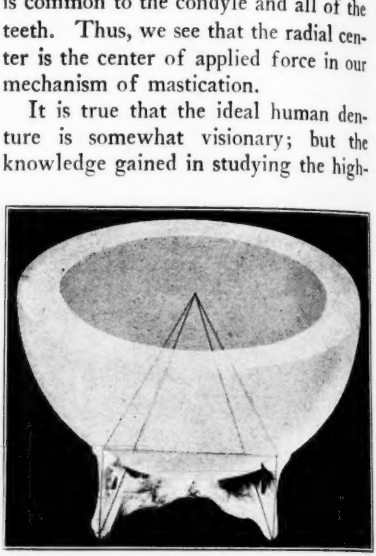


Fig. 7.—Posterior view of sphere applied to mandible. (Monson.)

What has been said regarding the ideal has been mentioned merely to reestablish in our minds a broader conception of our responsibilities, before

taking up the management of cases in which there has arisen serious impairment to the physiologic functions for which we should be responsible.

In the life of every individual there comes a time when various agencies act to destroy the human occlusion, and, owing to these retrogressive changes, little of the original is left. Functional efficiency has suffered to a considerable extent. In fact, the mere presence of retrogression may be taken as a definite expression of the lack of harmony in all coordinating parts, usually in a direct ratio to the amount of retrogression. In considering any loss of teeth, our first thought should be as to the seriousness of the condition, at no time losing sight of the fact that Nature has made some provision for taking care of the minor losses.

On each operator falls the responsibility of deciding at just what period in the patient's life these losses reach a point where it is advisable to cease basing our considerations on the individual tooth. He must recognize when such procedure has reached the limits of its usefulness and be able, at the proper time, to visualize the problem in its entirety. The incorporation of balanced occlusion into our restorative work means little change in our methods. What it does mean is that we must change our point of view. We must be able to make a mental picture that reaches beyond the individual unit—a picture that includes all the units working as one. It makes little difference in our routine mechanical procedure whether we build with our minds on the dental apparatus and its various functions in correlation or whether we build to perpetuate the existing deformities. However, our restorations must be designed in such a way that, when completed, they will function and maintain health, instead of representing something entirely out of harmony with Nature's plan.

It is well to remember that as long as any natural teeth remain on which some degree of function is possible, there will be exerted considerable muscle action and reaction. The result of these forces we have all seen clinically. For example, what happens when the posterior teeth are lost, and all function takes place on the anterior? In a short time, we find that owing to the muscular forces exerted over the unsupported bone the two opposing alveolar ridges are drawn together. In some instances, these actually come in contact. Another very common abnormality is the deflection of the mandible from one side to the other of the median line, due, as a rule, to long continued unilateral function, the teeth on the opposite side being lost or worn to the extent that they no longer counteract the forces applied on the functioning side.

As a result of these disharmonies, there are presented many of the worst types of deformities that we are called on to treat with restorative dentistry. The various agencies that act to destroy the human occlusion are distributing their forces in such a manner that changes and destruction are going on very rapidly. Muscle pull is being diverted in wrong directions. The remaining teeth are drifting out of position, and, in many instances, they cease to take the applied stress parallel to their long axis.

In any closure, from the original height of development, we have a reduction of the cubic contents of the oral cavity. This reduces the normal tongue space, with a result that this organ is forced back into the throat.[3] All related and interrelated function, such as deglutition, respiration and drainage, as well as the circulation in this region, suffers from this interference.

In overbite cases, the class which predominates, this change is the greatest. In the prognathic and the end-to-end types, the closure may not be so marked, and, as a rule, the disturbance of this vertical relationship does not take place so rapidly.

Dr. Prentice has called our attention to the traumatic conditions that arise in the glenoid fossae, when, as a result of the breaking down of the occlusion, this member becomes a weight sustaining joint.[4] In this connection, Dr. Monson gives us a thought worthy of consideration when he draws a comparison between the temporomandibular joint and the knee. The latter joint is primarily designed, both in size and shape, to sustain the weight of the body. The pounds of pressure exerted by the muscles of mastication in many instances is greater than the bodily weight. We can readily see that Nature, in designing the temporomandibular joint, made no provision for this tremendous force other than to distribute it over the occlusal surfaces.

In all periods in life, it is well to remember that the existing conditions in the glenoid fossae are the result of the transmission of those forces that have been active on the occlusal surfaces. In other words, the condition of the temporomandibular joint is always secondary to and governed by the teeth themselves. It is Nature's intent that the natural teeth serve as a guiding influence to prevent the condyle from coming in actual osseous contact with the glenoid fossae. This prevents injury to the meniscus and the joint. The observance of this natural law is one of the principle objects in view when building our restorations, so that, when completed, they will present an occlusal arrangement which, during mandibular movement, gives proper guidance to the condyle.

Do not lose sight of the fact that, as the occlusion ceases to counteract the muscular force in maintaining a proper relationship of the mandible to the maxillae, the direction of muscle pull is changed and the mandible and its suspended structures are carried backward and upward.[5] This condition is greatly pronounced in the overbite types, for, as the closure becomes greater, the overbite acts as an added influence in the creation of this distal relationship.

The result is that an overbite is established, which interferes with occlusal balance in the posterior region during all excursion of the mandible. The central occlusion relationship of the mandible to the maxillae will, in these cases, be distal from its original position.

3. Monson, G. S.: Impaired Function as a Result of Closed Bite, J.N.D.A., 8: 833 (Oct.) 1921.

4. Prentiss, H. J.: Regional Anatomy, Emphasizing Mandibular Movements with Specific Reference to Full Denture Construction, J.A.D.A., 10: 1085 (Dec.) 1923.

5. Monson, G. S.: Some Important Factors Which Influence Occlusion, J.N.D.A., 9: 498 (June) 1922.

The prognathic and end-to-end types, which form only a small percentage of the cases we treat, generally acquire a central occlusion relationship anterior to the original. It is obvious that the utilization of this central occlusion relationship as a guide in building partial denture restorations will result merely in a perpetuation of the existing malrelations.

Following all this disharmony in the dental apparatus, we find mandibular movement restricted to whatever freedom the remaining natural teeth will permit. In many of the severe cases, the interference with this function is so great that the mandible is limited to little more than an open and shut movement. However, no matter how great this interference may have been, except in cases in which injury or disease has caused the impairment, I have never handled a case that was not capable of accepting all the ranges of occlusion, when the existing interferences were wiped out and a new occlusion established which embodied the spherical principles.

The basis of every scientific procedure is made up by combining all of the natural laws involved. In the case of partial denture construction, the present deplorable state is due, I believe, in some measure, to our failure to observe the existing natural laws. In the past, much of this service has consisted merely of filling space in the dental arches with teeth and vulcanite.[6] Many times, as an extra feature, we would exercise the opportunity to make use of some favorite mechanical appliance, trusting that its use would overcome all the problems that came up.

Strict observance of the principles of balanced occlusion teaches us that, coupled with the mechanical phases, there are other vital considerations and possibilities. The dental profession today is realizing the fact that we have been paying too much attention to the mechanics involved and too little attention to the functional side of our restorations.

A summary of the reasons for the use of balanced occlusion in partial denture work shows that they are both physiologic and mechanical. Among the physiologic reasons, we have a betterment of all the functions directly or indirectly related to the occlusion. We may get some correction of the deformities that exist in the osseous parts. Generally, there is some improvement in the existing conditions in the temporomandibular joint when the load is taken off the condyle, and thrown back on the alveolar ridges, where Nature has made provision for its reception. This is accomplished by opening the bite and obtaining a better relationship between the mandible and the maxillae, then constructing restorations to maintain this relationship which have embodied in them the spherical principles of occlusion, to receive and distribute the applied stresses.

Does it not seem logical that, if many of the acquired deformities with which we are confronted are the result of a breaking down of the occlusion and a diversion of the stress to other parts in whose mechanical design Nature has made little or no provision for its re-

6. Little, A. P.: Filling Spaces or Building for Efficiency, Dent. Digest, 28: 777 (Dec.) 1922.

ception, with a proper correction and the reestablishment of occlusal balance any change would be for the better? This is but in accord with the natural laws that govern bone change.

With any correction that might come in the mandible itself from a redistribution of the applied stresses or from any improvement in the relationship of the mandible to the maxillae, gained by a bodily shifting, when possible, to a position nearer that which originally existed at the height of development, we will have the suspended soft structures working to a better advantage. As all function is more or less dependent on correct occlusion, it is only natural that, following correction, we find an improvement in the functional activities of the soft structures.

Balancing the occlusion affords an opportunity to improve the condition under which the remaining natural teeth receive the applied stress. In nearly all closures, the teeth receive the crushing force in other directions than those parallel to their long axis.[7] We all know this is contrary to the physiologic laws that govern the proper functioning of the pericemental membrane. A disregard of this factor in handling our cases will result in no improvement of the health of the investing tissue, and, as time goes on, tends to aggravate the already unfavorable conditions under which these teeth are functioning.

Among the chief mechanical advantages gained are: (1) we have more room for our restorations; (2) we can improve the shape and design; (3) the retention problem is materially modified; for we have the maximum occlusal contact in the various ranges of the mandible, a factor in tissue bearing restorations that has a tendency to keep them seated at all times, causing much less strain on the abutment teeth.

Following this review of the basic principles of balanced occlusion, we shall give some consideration to their practical application in partial denture construction. Naturally, if we are going to build our restorations to supply that which has been lost from the human occlusion, it will be necessary to make a careful mouth survey to analyze the conditions that the loss of the teeth have brought about. Here, too, our point of view must change: we must consider the physiologic as well as the mechanical problems that exist.[8]

Primarily, our thoughts, in the past, in making a mouth survey, were on the mechanical problems. While I do not wish to belittle the mechanics involved, they become merely the medicine with which we treat the disease. Where would medicine be today if physicians featured the selling of drugs as a prime factor in the service they rendered? Dentistry will make a great step forward when we cease to hold mechanical dentistry out to our patients as our main contribution to the healing art. After our analytic deductions there will be ample time to work out the best possible mechanical program to fit the special needs at hand; and I assure you that, with such a logical procedure, the number of our mechanical failures will be greatly reduced.

The patients that come in for partial denture service, generally speaking, show an oral functional efficiency greatly lowered because of loss of the

7. Smith, Tom: Traumatic Occlusion and Its Correction in the Treatment of Pyorrhea Alveolaris, J.N.D.A., 8: 971 (Dec.) 1921.

8. Aldrich, H. D.: Mouth Survey with Special Reference to Malocclusion and Lost Facial Dimensions, read before Iowa State Dental Association, December, 1920.

teeth. They generally have had dental service rendered on individual teeth here and there, with no consideration of the mouth in its entirety. Their ideas and knowledge of dentistry are largely the result of these experiences. Our first problem, then, is one of changing their point of view from that of unit dentistry to a consideration of the dental apparatus in its entirety; in other words, an educational talk is necessary, covering all functional responsibilities directly or indirectly related to the occlusion. This should serve a two-fold purpose: that certain knowledge may be imparted to the patient relative to the changes that have taken place in his own mouth, and that the operator may gain some valuable information as to the type of patient he is dealing with. If such an educational talk, based on the physiologic points involved, makes no appeal to the patient, further procedure will bring forth little gain. It is necessary, in carrying out a program of balanced occlusion, to have the patients interested enough in their own welfare to give at all times their fullest cooperation.

It is advisable at the end of this interview to ask the patient a few simple well-directed questions, with the idea of seeing just how much of the talk is understood. We may have been too technical, and we must not lose sight of the fact that such educational talks, while they may seem somewhat rudimentary to us, are entirely foreign to our patients. This fact applies as well to the better educated patients.

In order not to get the patient's mind away from the physiologic trend of thought, it is well, at this time, to make no mention of mechanics or of fees. As all this is a new line of thought to most patients, they may take some time to think things over before showing any real interest. The patient who is too easily enthused is generally as quickly discouraged.

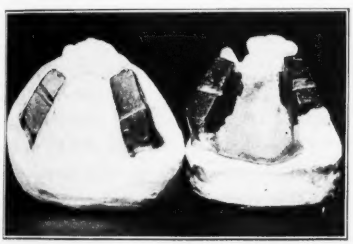


Fig. 8.—Graft's base plates, with modeling compound occlusal rims.

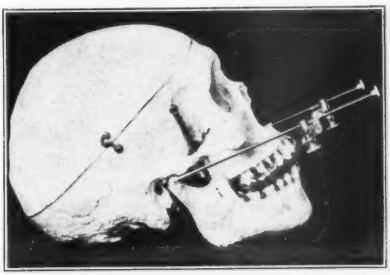


Fig. 9.—Registering the relation of the condyle to the occlusal surface of the teeth by the use of the transfer bow.

After we have created in our patients an interest and a desire to go farther, two plaster casts should be made, including all the detail necessary for a clinical study of the case. By means of a transfer bow technic, these should be mounted on an instrument that is capable of reproducing the movements of the mandible, and on which provision has been made for determining the individual problems presented that may be due to developmental deficiencies or to the loss of teeth.

When transferring and mounting casts, in cases in which the posterior

teeth are missing, it is necessary to construct base plates and occlusal rims to hold the casts in position while going through the various steps. (Fig. 8.) These base plates should be of a nonyielding type, and the occlusal rims are most satisfactory when formed of modeling compound. It will be noted that the occlusal rims are notched. This is done for a definite purpose. While being attached to the instrument, the upper cast must be held in position by means of a check-bite wax, which will

Fig. 10.—Marking the location of the condyle on the patient.

facilitate in assembling and maintain the correct position of the casts.

Figure 9 visualizes the theory of just what we endeavor to accomplish by the transfer; that is, to register the exact distance from the center of the condyle to the occlusal surfaces of the teeth, in order that we may have a like relationship between the occlusion of our casts and the axis of movement on the instrument. When put in practice, this operation becomes merely an approximation; for it is absolutely impossible to arrive at that degree of accuracy shown in the picture when trying to locate the center of the condyles in the living. However, we attempt to be as accurate as possible, for the better the transfer technic, the less the adjustment of the instrument necessary later on.

Figure 10 shows the location of the

Fig. 11.—Adjusting the ends of the transfer bow to the markings on the patient.

condyle. In the average patient, it will be found that a position one-half inch anterior to the center of the tragus of the ear and on a line with the tip of the nose will be very close. In some cases, through palpating, we may see fit to change our markings for a better location of the center of the condyles.

Fig. 12.—Anterior view of the transfer bow in position and adjusted.

A piece of check-bite wax is secured to both sides of the transfer plate and inserted in the mouth, and while the wax is warm, the patient is asked to

close. (Fig. 11.) The ends of the transfer bow are adjusted to the markings on the face, and both friction screws are tightened on the transfer bow.

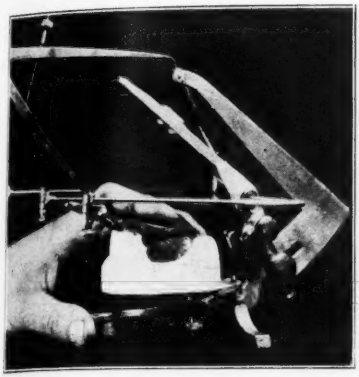


Fig. 13.—Mounting lower cast on instrument.

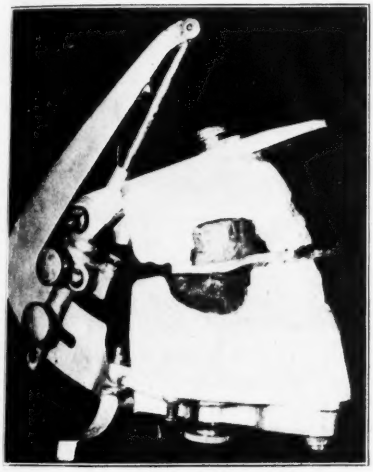


Fig. 14.—Securing upper cast to instrument.

Figure 12 shows an anterior view of the transfer bow in position and adjusted.

Figure 13 shows the method of mounting the lower cast to the dividers at 4 inches. The incisal edge of the lower teeth should be 4 inches from the top of the instrument. The posterior part of the cast is taken care of by having the ends of the transfer bow intersect the condyle rods equidistant from the ends of the rods. This being accomplished, the lower cast is secured to the instrument.

In Figure 14, the upper cast is also secured to the instrument. In order to do this, the check-bite wax, which was

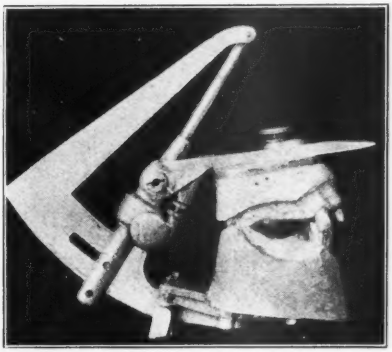


Fig. 15.—Cast mounted showing the amount of closure (right side).

made at the time of the transfer, is placed on the lower cast and base plate; and the upper cast and base plate is placed on the check-bite, which will maintain the correct position of the upper cast while it is being attached to the upper cast carrying plate of the instrument.

Figure 15 is a view of the right side of the mounted case, occlusal rims being removed to show the amount of closure. Figure 16 is a left view of the mounted case.

In making our clinical deductions to determine the amount of restoration required, it is necessary to divide the

mouth survey into two parts: the examination of the patient, and the study of the mounted casts. In the examination of the patient, the oral, facial and condyle conditions should be noted, and a complete set of radiograms should be taken not only of the remaining natural teeth but also of the ridges.

Fig. 16.—Same as Figure fifteen (left side).

The oral examination consists of a study of the entire mouth with observation of the remaining natural teeth, the relation they bear to each other and their state of health. We should note how the remaining teeth are receiving their applied stress, ruling out any teeth whose inclination would make it impossible to improve the conditions under which they are receiving these applied stresses. Whether the existing deformities are congenital or acquired, or a combination, is determined. We must make certain that the ridges are free from infected areas, and we should not accept the responsibility involved in the pres-

Fig. 17.—Casts opened and in position of new central occlusion.

ence of oversized maxillary tuberosities and other osseous projections that would mean too much of a compromise or interfere with the mechanics involved. The operator should try to detect any tongue or lip habits that might be troublesome during and after treatment.

The facial examination often reveals external evidences of closure, such as

shortening of the lower third of the face, with the accompanying thick lips and receding chin, and the deep lines extending over the lower third of the face and especially from the corners of the nose to the corners of the mouth.

The condyle examination is made for the purpose of testing any condyle encroachment that might occur as a result of closure. The test for condyle encroachment will be shown in detail later.

Fig. 18.—Positioning guide.

All these clinical observations are made while examining the patient, and any conclusions arrived at are valuable aids in studying the mounted case, to which we will now turn our attention.

The casts are opened to slightly plus clearance in the forward range, the incisors being brought to an end to end relationship which is a general guide in this type of case to the amount the bite must be opened to relieve condyle encroachment and abnormal stress on anterior teeth. (Fig. 17.) When this is done, all the control screws on the instrument are locked. The casts are now in a position of new central occlusion.

Fig. 19.—Testing for condyle encroachment.

Figure 18 illustrates what is termed the "positioning guide." Its object is to duplicate the same relative position of the mandible to the maxillae in verifying in the patient's mouth our diagnosis that was made on the instrument.[9] It is made by placing a small piece of soft

Fig. 20.—Balanced occlusion guide.

modeling compound between the upper and lower anterior teeth and closing the

9. Bird, C. K.: Reasons and Technic for Obtaining Balanced Occlusion in Fixed Reconstruction, Dent. Summary, 45: 291 (April) 1925.

upper cast in the new locked central occlusion. The cast is then chilled and removed. It is now ready for the patient's mouth.

Figure 19 illustrates the method of making the test for condyle encroachment. To make this test, the tips of the little fingers are inserted in the external auditory meatus and the patient is asked

Fig. 21.—Balanced occlusion guide. Technic for correcting the occlusal rims.

to open and close to central occlusion. As the patient opens, the operator pulls forward. The tips of the fingers will follow the advancing condyles. As the patient closes, there will be a decided thrust of the condyle heads felt against the tips of the little fingers if the bite is appreciably closed. Now the positioning guide is taken to the patient's mouth and the same test is made. We are now making this test to our newly established central occlusion. The condyle trust will now be materially decreased if not entirely absent, which demonstrates that this condition can be relieved only by opening the bite. Observance has revealed the fact that, in certain types of cases, reducing this condyle trust or encroachment by opening the bite is a valuable guide in determining the correct relationship of the mandible to the maxillae.

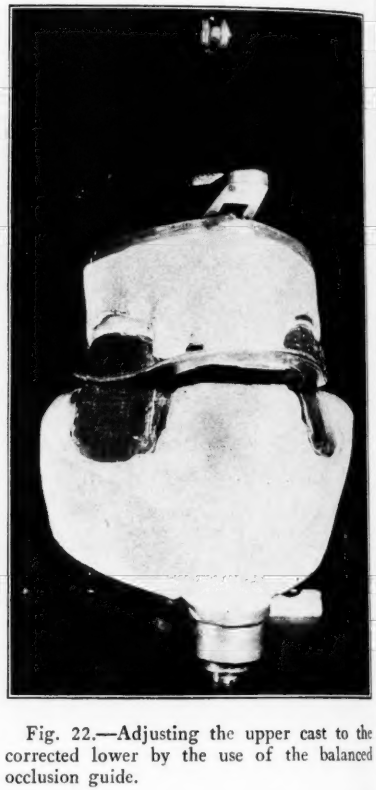


Fig. 22.—Adjusting the upper cast to the corrected lower by the use of the balanced occlusion guide.

We have now determined the amount to open the bite, which is approximately the amount this case has retrogressed from its original height of development.

The next step is to design restorations whose occlusion presents an arc that is the same as the arc of mandible movement.[10] For facilitating this procedure, Dr. C. K. Bird of St. Paul conceived the balanced occlusion guide. (Fig. 20.)

The balanced occlusion guide is a plate of german silver stamped to conform to the surface of a sphere and perforated for a definite purpose. Its use makes it possible to know in advance whether the arc chosen will, when incorporated into our restoration, give us a balanced occlusion. The essential technical steps in making this test are illustrated.

The base plate and occlusal rims used in making the transfer are placed on the lower cast. (Fig. 21.) Now, by measurement, we determine to what extent the occlusal rims will have to be altered in order that all edges of the balanced occlusion guide shall be equidistant from the radial center of the instrument. This is done by building up the occlusal rims with soft modeling compound and forcing the balanced occlusion guide to the correct radius, as determined by the dividers, care being taken to maintain the same radius on the guide all the way around. When this is accomplished, the next step is to add compound to the concave or palatal side of the guide.

To do this, the upper cast is moistened. (Fig. 22.) Soft compound is placed on the balanced occlusion guide, a small amount being forced through the perforations in the center, which will act in retention. Now the upper cast is placed on the corrected occlusal rims of the lower, and is closed until the longest remaining natural teeth come in contact with the guide, which is adapted to the cast and chilled. In using the balanced occlusal guide in partial denture cases, it is very important that the result of this step shall give us an accurate impression of the ridges and palate, for in the absence of natural teeth, the guide, when taken to the mouth, must be firmly supported by the ridges and palate.

It is now ready for the test in the mouth. (Fig 23.) The corrected lower occlusal rims are removed from the lower cast and placed in position in the mouth, the balanced occlusion guide is inserted and the patient is asked to close and go through the various ranges of mandibular movement. During these excursions of the mandible, the guide should remain in continuous occlusal contact with the lower occlusal rims. After such a test, it is obvious that the utilization of this newly established arc as a guide to build the occlusion will give a balance in all the ranges.

Fig. 23.—Testing the occlusal rims in the mouth for the various ranges of mandibular movement.

The lower restoration is made first. (Fig. 24.) The balanced occlusion guide is placed back on the mounted casts. The occlusal rim is removed from the base plate on one side, the occlusal rim on the opposite side being left intact to maintain the proper height for

10. Little, A. P.: Occlusion and Its Significance in Partial Denture Construction, read before the New Jersey State Dental Society, April, 1923.

the lower teeth. The teeth are now set up to the guide, with both the buccal and lingual cusps in contact. When this is accomplished, the occlusal rim is removed on the opposite side.

These teeth are set up to make contact with the balanced occlusion guide. (Fig. 25.) The lower teeth now present the same arc and same height as did the occlusal rims which were used in the test.

Fig. 24.—Setting lower teeth on right side to balanced occlusion guide.

We are now ready to construct our upper restorations. (Fig. 26.) The positioning guide, which was used in the diagnosis to determine the amount of opening, is placed between the casts, and the instrument is locked to maintain this position. This gives the same relative position to the casts that the mandible had to the maxillae during the diagnosis.

With the instrument in this relationship, the positioning guide is removed. (Fig. 27.) A base is adapted to the upper cast and the teeth are set to occlude with the lowers in central occlusion. Now the friction screws are released on the instrument. The occlusion is noted when the various movements such as forward and lateral are made.

All the teeth should be in maximum balanced occlusion. We should bear in mind that the mandible travels slightly forward as it moves laterally, and be

Fig. 25.—Lower set-up showing teeth in contact with balanced occlusion guide.

sure that provision is made for this in the arrangement of the teeth.

After the teeth are arranged in a balanced occlusion on the instrument, the case is tried in the mouth, and check-bites are made in the forward and both lateral ranges. This step is very important in so far as it is the means whereby we prove or disprove the accuracy of the mounted case. Great care should be exercised to avoid distortion during the making and subsequent handling of the check-bite waxes. The method employed in making a check-

bite wax is as follows: The check-bite wax is softened in warm water, and is placed in the mouth, and the patient is

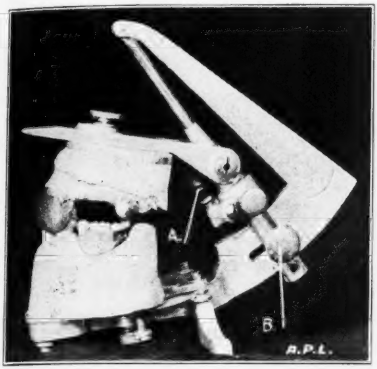


Fig. 26.—Adjusting casts on the instrument by the use of the positioning guide.

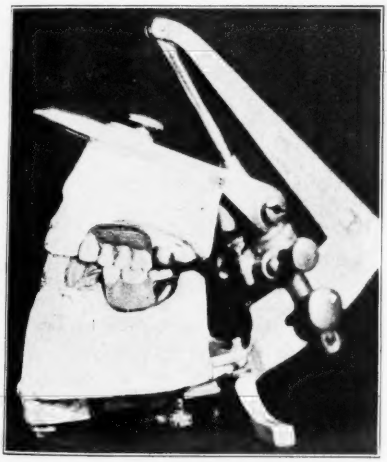


Fig. 27.—Upper teeth set to the new central occlusion relationship.

asked to close gently in the desired range, care being observed that the teeth do not pass entirely through the wax in any place, the reason for this being that, with cusp influence, we will have unequal pressure, not only on the underlying tissue but also in the compressible portion of the temporomandibular joint. As each check-bite is made, it should be removed from the mouth and chilled, then reinserted in the mouth, and the patient made to close in the same position in the chilled wax. This will tend to correct any distortion that may be

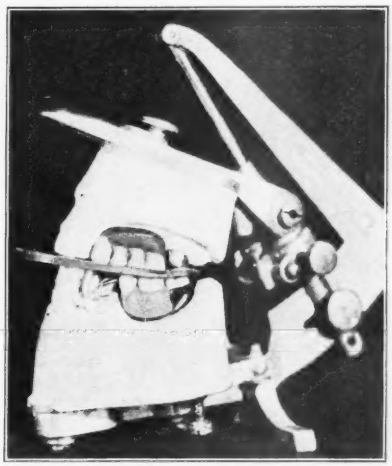


Fig. 28.—Use of check-bite wax to verify the correct mounting of casts on the instrument.

present. Owing to the physical changes which wax undergoes when left lying around, it is advisable to take the case to the instrument and make the test at once.

All the control screws on the instrument are released. (Fig. 28.) One of the check-bite waxes is placed on the lower occlusal surface and the upper is adjusted into its respective impression in the wax, the same test being made with the other two check-bite waxes. Assuming that the teeth set up in wax

have not become distorted, it would seem logical that a failure to make the casts fit properly into the check-bite waxes means that, during the transfer or in mounting casts on the instrument, we have failed to get the casts in the same relationship to the mechanical axis of movement on the instrument that the natural teeth bear to the condyles. If such is the case we adjust the instrument

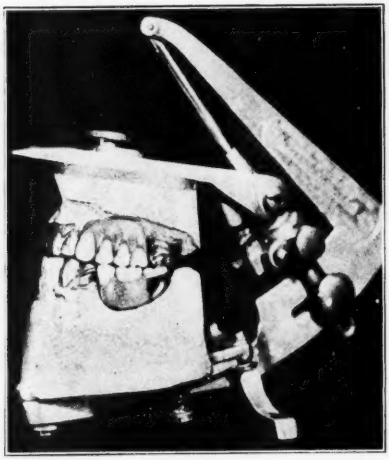


Fig. 29.—Finished case in central occlusion.

by means of the jackscrews underneath the lower cast carrying plate until the casts fit in all three check-bites. The teeth are then rearranged to a balanced occlusion in this corrected relationship.

Now, with the corrected occlusion as a guiding factor to control the movements of the instrument, the occlusion of any individual teeth that need restoration is waxed up and the case finished.

Figure 29 shows the finished case in central occlusion; Figure 30, the balanced occlusion in the left lateral range, and Figure 31, balanced occlusion in the right lateral range.

Figure 32 illustrates balanced occlusion in the forward range. Note that the anterior teeth are not in contact. This is done for a definite purpose. After the case is inserted in the mouth,

Fig. 30.—Balanced occlusion in left lateral range.

certain changes take place, consisting of a rearrangement of the gum tissue when continued pressure is applied and farther resorption of the alveolar process when work is placed on it. With these changes, which vary in different parts of the mouth, we find it necessary to adjust the base or regrind the occlusal surfaces. Each or all of the foregoing are factors in bringing the mandible in

closer apposition to the maxillae. This naturally acts to close the space between the anterior teeth. Our ultimate aim is to have the teeth in maximum continuous occlusal contact during all ranges. If tissue-bearing restorations are constructed so that the occlusion is

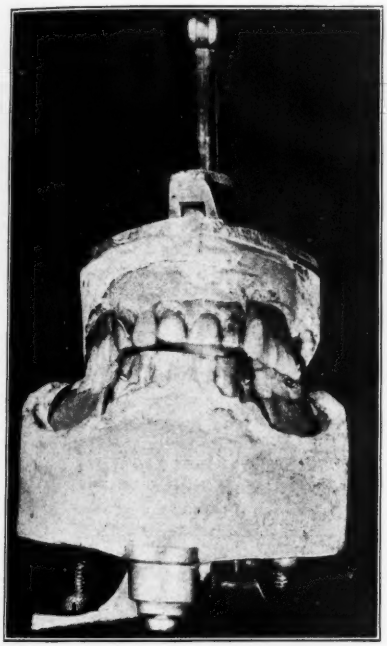


Fig. 31.—Balanced occlusion in right lateral range.

continuous at the time of insertion, we will have created, following these changes, an overbite that will throw the posterior teeth out of balance during the various excursions of the mandible.

It cannot be denied that the element of compromise enters into this work, just as in all other dental operations. The factors which govern compromise in other dental operations will also govern it here. In many cases, after analytic study, it may be found that the correction is too great to be accomplished in one restoration. In some cases, the retrogression may be so great that it will be necessary to carry them over a period of time as treatment cases before reaching the ultimate goal. In reality, compromise, which we all know at times is necessary, becomes a personal

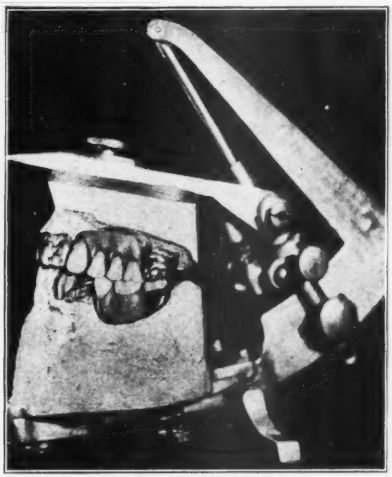


Fig. 32.—Balanced occlusion in the forward range.

matter between the dentist and the patient, determined by the case at hand.

One very important thing to consider when incorporating balanced occlusion into tissue-bearing partial denture construction is the matter of proper bases to receive the stress. This work varies somewhat from the ordinary partial denture, which is generally built to the existing central occlusion, no matter how bad it may be. Many of these cases present malocclusion, which acts to limit mandibular movement. Any interference in the movements of the mandi-

ble results in a diminution of the muscular efficiency. The construction of a new occlusion built to conform to the spherical principles permits the mandible to move freely in its various ranges. This freedom of movement results in a return of muscular tone. As a result, the muscles become capable of exerting great pressure. To counteract this pressure, the bases upon which the occlusion is constructed must be as large and extensive as possible. In many cases, the entire load is thrown on the restoration; as, for example, when the restoration involves a case with a big over-bite, the posterior teeth having been lost. In such cases, small saddles commonly employed in partial denture work do not present sufficient seating area to withstand the muscular force exerted.

Before commencing the construction of tissue-bearing partial denture restorations, the patient should be informed as to the transitory nature of this work. He should be educated to expect that maintenance of the restoration will be necessary for proper function. This is important. Without such an explanation, the patient generally judges this work in the same light as fixed dentistry. When these cases are rendered useless owing to the changes that take place, the blame is generally placed on the dentist. Failure to impart this information regarding the upkeep generally results in the patient becoming disappointed in this type of work.

After a review of the principles which underlie the practical application of balanced occlusion to partial denture construction, it becomes very evident that the dentist who can see only the problem in terms of gold, vulcanite and teeth can never succeed in this branch of restorative dentistry. Unless he has a proper conception of the anatomy and physiology of the parts involved, it will be very difficult to differentiate between deformity and the ideal. To build our restoration to the existing deformity will never solve the problems that surround this work today. However, to be able to recognize what retrogressive changes have taken place after the loss of the occlusion will be a material aid in the solution.

DISCUSSION

Mark E. Vance, Lincoln, Nebr.: Quoting from Dr. Little's paper: "To have perfect relationship and perfect coordination of all parts would be to have an ideal. The ideal is that which exists only in imagination. In many of the sciences it is necessary, however, that we use the ideal as a standard of measure in making our deductions. For that reason, in the study of balanced occlusion we lay our foundation or basis in the ideal human denture." The ideal we must keep in mind at all times. While in dental college, I learned the making of gold foil restorations; an almost lost art in dentistry today, I regret to say, owing largely to the invention of the gold inlay and the development of porcelain. In the making of every gold foil operation, I have constantly before me the ideal. I have had a mental picture always before me of the foil restoration which Dr. C. N. Johnson tried to teach me. I have never attained the ideal by any means, but I often see some of the foil operations which I made fifteen and twenty years ago or more, and they are preserving the tooth structure, while some of my later work in inlays and porcelain has failed. There is fortunately a tendency today in some parts of the country toward a return to gold foil, which in my estimation is the nearest to the ideal for tooth preservation This does not apply directly to what Dr. Little has tried to give us in his paper, but what I am pointing out is the necessity of striving for the ideal not only in balanced occlusion in partial denture construction but in all we do in dentistry. The man whose principal aim in the profession is, "to make a lot of money quick," as expressed by a young man who graduated in my class, will have no ideal nor ideas of any ideal. Money does not reward one's effort in dentistry. It is the satisfaction of having rendered an

honest service conscientiously performed. The financial remuneration will come to such a man. The opening of the bite in constructing partial dentures, full dentures or fixed bridgework is a procedure overlooked by most men, judging from my observation. I have been somewhat in touch with the work which Dr. Little is doing, and since studying the principles of balanced occlusion, I have had a far greater understanding of what the effect on the supporting tissues of the oral cavity is when the occlusal balance has been disturbed either by loss of teeth, occlusal wear or improperly constructed restorations. The scientific work which Dr. Little has given us in his paper has brought the profession to a realization of how much proper occlusion of the teeth, be they natural or artificial, has to do with the "functions of mastication, deglutition, respiration, the drainage of the oral cavity and posterior part of the pharynx, the equalization of air pressure in the middle ear through the eustachian tube, and the supply of blood to these parts are dependent."

Referring to Figure 5, it takes no stretch of the imagination to see what happens to the oral tissues if they are compressed and forced out of their normal position. And yet, until someone like Dr. Little points these things out to us, little thought is given to it. I wish I could throw on the screen this same illustration with the oral tissues compressed and forced out of position as they must be when proper occlusion is disturbed. Illustrations may speak louder than discussions.

I have opened the bite in mouths for many years and have been criticized by other dentists for doing so, but while I hardly knew what effect it was having on the oral tissue, I rarely found a patient that did not seem benefited by having more space for these tissues. In most partial denture cases, the saddles are entirely too small. The seating area should be as large as possible. This I noted in Dr. Little's practical cases which I have seen in his office. I was quite surprised at first at the weight of materials which Dr. Little used in all such cases, but I am satisfied that many cases are failures because of the lack of rigidity which the added bulk of material gives. Education of the patient in what we are endeavoring to do is an essential thing. Without it, many cases are doomed to failure from the beginning. This same thing applies to all kinds of fixed or removable restorations, fillings, inlays and all work done in the mouth. Changes in the oral tissue, which will occur in every mouth after restorations are made and worn, are absolutely beyond the control of the dentist. This the patient should thoroughly understand in order that he may give to the dentist the thorough cooperation necessary to the success of any restoration. Most dentists are general practitioners, and comparatively few specialize in any one branch of dentistry. Therefore, if the suggestions made by Dr. Little, and his procedures, are not applicable to the everyday work of the general practitioner, they are of comparatively little value. Likewise, if the general practitioner does not understand the application of these procedures to his everyday operations, they are of little value to his patients. I speak on this subject from the standpoint of the general practitioner.

A STUDY OF FORTY-THREE MAXILLARY SINUSES*

By HARRY N. BOYNE, M.S., D.D.S., Omaha, Nebraska

A CERTAIN amount of investigation of the maxillary sinus has been carried on by such men as Cryer,[1] Schaeffer[2] and Davis.[3] Their work has been in conjunction with the accessory sinuses of the nose. An isolated study of the maxillary sinus would reveal many interesting facts, and this has been undertaken by no one except Loeb, whose investigations have been limited to the shape and capacity of the antrum. There remains an abundance of information to be obtained regarding the size, shape, relations and the different openings which exist in many of the sinuses. The study of the sources of pathologic change, namely, the teeth and the accessory sinuses, would be of great interest to the dentist and the rhinologist. To the investigation of some of these matters, the present study of forty-three human maxillary sinuses has been devoted.

The material obtained for this study was secured from the anatomic laboratory of Northwestern University Dental School. Most of these subjects were patients that had died at Cook County Hospital. We obtained the data as to the ages, weights and nationalities at the demonstrator's morgue. It could be said that the average subject was a day laborer and that he probably practiced poor hygiene.

The forty-three maxillary sinuses studied were all in adult male subjects, except one, a young girl, the group consisting of one 15 year old Mexican girl, three negroes and nineteen white subjects. The ages ranged from 15 to 66 years.

ANATOMIC FEATURES

As regards the anatomic features revealed by this study, the most common differences were those in form, size and communications of the maxillary sinuses. Pneumatization of the maxilla was marked in more than 90 per cent of the cases. The maxillary sinuses examined were larger than the other accessory sinuses, with the exception of two normal, symmetrical sinuses in one specimen, in which the sphenoidal sinus exceeded the maxillary sinus in size, and two others that were made very small by hypertrophic cystic degeneration and polypoid formation of the mucous membranes. These sinuses were very irregular, presenting many odd shapes, varying from the typical form which is described in various textbooks.

1. Cryer, M. H.: Internal Anatomy of the Face, 1916.

2. Schaeffer, J. P.: The Sinus Maxillaris in Man, Am. J. Anat., 10: 244-255; The Nose and Olfactory, 1919.

3. Davis, Warren B.: The Nasal Accessory Sinuses, 1914.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Sixty-Seventh Annual Session of the American Dental Association, Louisville, Ky., Sept. 22, 1925.

In the main, the sinus followed the shape of the maxilla, but the processes may be pneumatized in a varying degree. The zygoma was found to be partially pneumatized in all but four specimens.

The maxillary sinus may be described as having a roof, floor and three walls. It is lined with mucoperiosteum, surmounted by ciliated epithelium in normal sinuses. The walls of the sinus vary in thickness, but may be attenuated to a very delicate texture.

In rare cases, the sinuses may be absent on one or both sides; but, in our series, the sinuses were normally developed and functioning, with the exception of the pathologic sinuses.

The anterior or facial walls were rather smooth, with a slight depression, which varied according to the position of the infra-orbital canal. In a few specimens, the roots of the cuspids and bicuspids were located in this wall. The plate of bone forming the facial wall varies in thickness and density in different skulls; and in the same individual. The posterior walls of the sinuses correspond to the infratemporal surface of the maxilla, and, in our series, with two exceptions, were found to be very thin.

The nasal wall, which is considered the base, encroached on the sinus in 55 per cent of the specimens. In a disarticulated skull, the bony defect in the nasal wall is very large and irregular; but, when the skull is intact, this opening is largely closed by the perpendicular part of the palate bone, maxillary process of the inferior nasal concha, uncinate process of the ethmoid bone and a portion of the lacrimal bone. These irregular parts were covered by mucous membrane, which also bridged over the bony defects and was continuous with that of the maxillary sinus through the ostium maxillare. The nasal wall just beneath the attachment of the inferior nasal concha was found to be very thin in all cases except those that showed pathologic changes.

The floor of the maxillary sinus is formed by the alveolar process of the maxilla, and we found it much thicker than any of the other boundaries of the sinus, the thickness being controlled by the pneumatization and resorption that takes place. In a number of the floors of different sinuses, the root apices came into very close contact, and in those specimens that had posterior teeth, the roots were instrumental in making the floor of the sinus uneven. The relation of the teeth to the sinuses was not constant, owing to the variation in the size of the maxillary sinuses in different skulls, and also on the two sides of the same skull. The floors of the maxillary sinus were found to be below the nasal fossa in 93 per cent of the specimens, which indicated that the alveolar processes were hollowed out to a certain degree.

The roof of the sinus was usually a triangular, and a very thin plate of bone. The surfaces were marked by a ridge of bone which contained the groove for the passage of the infra-orbital vessels and nerves. This groove was not constant in its origin and course. We have noticed that, instead of taking the central course, as is usual, the groove has sometimes been directed from the medial side of the roof. The extent of the dipping-down of the ridge varied greatly, being scarcely noticeable in some specimens, while in others it extended so far that the canal became a

tube passing diagonally through the sinus. The roof in two of the sinuses was partially divided into two plates, separated and forming an infra-orbital sinus the opening of which leading into the ostium of the maxillary sinus.

Practically all of the sinus walls examined were uneven and irregular, because of crescent-shaped ridges, thrown from one wall to an adjacent wall, across the angle of their union. The larger ridges usually resembled Gothic arches. They were so arranged as to furnish reinforcement of the walls. In one case, we found a fibrous septum in a vertical anteroposterior plane, which was complete, with the exception of a perforation about the diameter of a small pea. This opening was located in the center of the septum, and the latter divided the sinus into almost equal medial and lateral parts. To establish drainage through the nasal route by perforating the inferior meatus or any other single route would have been impossible in this case. The membrane was thin and tightly stretched, resembling the head of a drum.

In the series examined, thirty-eight were found in which the walls presented ridges and septums. The greater number of this group fell into an important class. These deep recesses would prevent drainage by any single route. The majority of the ridges were made up of soft and hard tissue, the base usually of osseous structure and the remaining portion of a fibrous nature.

The location of the ostium maxillare, in the series observed, was found to be constant, with slight variation in respect to its relation to the floor or bottom of the hiatus semilunaris. Practically every opening was just beneath the bulla ethmoidalis, and this location in the adult corresponds to that of the primitive maxillary pouch. We found one maxillary sinus which had a direct communication with the frontal sinus on the same side. The communication was anterior and on the same level with the ostium maxillare. The ostium maxillare varied in size, ranging from 3 by 2, to 9 by 5 mm. In many of the specimens, the ostium maxillare varied in length, from 2 to 4 mm. It was found in either an upright or vertical position and opened into the floor of the hiatus semilunaris. When the maxillary sinuses have openings as described above, it is easy to see how readily the condition of the maxillary sinuses could become pathologic by being subjected to drainage into their openings.

The duplicate ostium maxillare is rather rare. We were able to locate three, in line, close to the normal opening. Two of the three had a common opening by way of a short tube which then opened vertically into the hiatus semilunaris. The size of the duplicate ostium maxillare in the three specimens was relatively the same as that of the normal openings.

The accessory maxillary ostium appeared in 21 per cent of the specimens examined. There was one specimen which had three openings leading into the sinus; namely, a normal, a duplicate and an accessory opening. The accessory openings, with one exception, were all located in sinuses that revealed pathologic changes. These openings were all smaller than the normal openings, with one exception. This particulary large accessory ostium maxillare measured 18 by 11 mm., and was also

situated in the sinus that showed the greatest amount of pathologic change, this appearing also in the nasal cavity about the ethmoid cells, and causing partial obliteration of the normal ostium maxillare. To convey a better idea of the size of this opening: it was possible to insert the tip of one's little finger into the sinus through this opening. These apertures, as stated before, varied in size and ranged from 1 by 2, to 11 by 18 mm. They were all posterior and somewhat below the normal opening, situated above the inferior concha. The undefended area, as described by Schaeffer, was the constant location of the accessory ostium maxillare. These apertures did not resemble the normal opening in size or appearance.

The nasal walls of the sinuses examined were very thin and delicate, especially in the area where the openings were found. As they were all adult specimens, we found in every instance, except one, a large amount of attenuation. The sinus walls thus become thinner and thinner up to a certain limit as age advances. The hollowing process seemed to progress unevenly, as noted by the very uneven walls of many of the sinuses. On the nasal wall, it was noticed that an area located between the uncinate process and the inferior concha was composed merely of two layers of abutting soft tissue, one of the layers being the lining of the middle meatus, the other the lining of the maxillary sinus. It would seem plausible, with this condition existing and in the presence of a pathologic process in a large number of cases showing an accessory ostium, that these were due to degenerative processes.

CAPACITY

The forms of these sinuses were studied from wax casts before the sinuses were denuded of their soft tissue. The method that we pursued, as to capacity and measurements, in obtaining our wax casts, may be described briefly. We first decided on beeswax and paraffin for the cast, as it was easy to handle, and could be teased out of the different parts of the sinuses. After these parts were assembled, they were weighed in air, and then in water, so as to compute the volume by displacement; allowance being made for the thickness of the saw blade. The measurements were then taken from the wax patterns with calipers. We were able to get a very definite size and shape, including all the recesses, growths and ridges. The uneven floors caused by unerupted teeth and the projection of the roots were well defined in these patterns. After obtaining the wax patterns, we made a study of the soft tissue and, after the preparation of the heads in the usual way, we examined the bony structures and the teeth. The range of capacity of the sinuses studied was from 2.5 to 24.2 c.c. In the smallest sinus, there was considerable pathologic change, which accounts for its small cubical contents. The largest sinus was an odd one, and all the processes were well hollowed out, which naturally made the boundaries very thin. The variation between the capacities of the paired sinuses in ten of the skulls was not more than 1 c.c. When a great difference in the two sides existed, pathologic change played a large part in restricting the size of the smaller sinus. The smallest symmetrical pair of sinuses, from one colored specimen before mentioned, with every-

thing apparently normal, were 4.18 and 4.8 c.c. The average capacity of the maxillary sinuses was approximately 12 c.c. This average included the sinuses that showed pathologic change, which, of course, would lower the average.

Three measurements of the size of the different sinuses were taken; namely, the anteroposterior, the superoinferior and the mediolateral. The anteroposterior measurements were found to exceed in 72 per cent of the specimens. The superoferior have approximately the same percentage over the mediolateral measurements.

The size of the sinuses may be controlled by the age, but in the comparison of the sinuses of the 15 year old girl with the smallest pair from a man, aged 40, we found the former approximately three times the capacity of the latter. Furthermore, the former varied but 0.46 c.c., each from the other, and were free from pathologic alteration. They exceeded in size thirty sinuses of our series of forty-three.

A comparison of the right and left sinuses of the same pair in five cases without pathologic change showed that there is a tendency for left and right sinuses to be approximately the same size, with the left always somewhat smaller.

DENTAL RELATIONS

Among the specimens examined, eleven maxillae were found with a full complement of teeth, and the same number edentulous. In comparing the floors of the sinuses in each group, it was found that the maxillae that had the teeth were much more irregular, owing to the presence of the roots, and in some cases the unerupted third molars. All of these specimens were examined by the roentgen ray, and rechecked with our observations. The balance of the group, numbering twenty-one, each had from two to five teeth missing.

The roentgen ray revealed eleven different regions of rarefaction, all of which happened to be in separate specimens. All of these regions were in rather close proximity to the floor of the sinuses, and, on examination, about 50 per cent of the radiograms gave the impression that the maxillary sinus might be involved. When the bone was examined about these different roots, it was found that the external plate of the maxillae was destroyed, and not the sinus floor. Defects in the outer alveolar plate, due to pathologic processes, varied in size from that of a pea to that of a small hazelnut. Of this group which revealed pathologic change, only one had a direct connection into the sinus. The aperture was about the size of a small buck shot, and there was a localized soft tissue growth over the opening.

The floors of all of these sinuses, except in one instance, appeared in very good condition, with no sign of pathologic interference; hence, from our observation, it could be said that the teeth played a very limited part in causing the pathologic conditions found in the sinuses.

When the teeth develop, grow down and take their normal places, the sinus gradually enlarges. Whenever a tooth which is located adjacent to the sinus fails to erupt, or is slow in erupting, the hollowing out of the sinus is checked at that particular place. We were able to detect two third molars which did not erupt and which produced the condition described above. This condition was

also found where roots of teeth were left in the jaw in old age. Resorption over these roots will not progress as in parts that are free from roots. We have noticed that very close relationship frequently exists between the teeth and the maxillary sinus. Direct communication between the roots of the teeth and the lining membrane of the sinus was due to the extreme hollowing out of the alveolar process of the maxillae, which occurred in a number of our specimens as a result of old age. It was observed that the number of teeth that had a direct relation to the sinus was necessarily inconstant. The tooth which bears the closest relationship to the maxillary sinus is, in the majority of cases, the second molar; next in order is the first molar, and next, the third molar. When the maxillary sinuses are very large, all of the teeth, up to and including the lateral, may be in relation to the floor of the sinus. There were three specimens in which this particular relation existed—in two, a cuspid, and in one, a lateral incisor was involved. The close proximity would give the impression that the maxillary sinus was more often infected from diseased teeth than any other source, some authorities claiming that more than 60 per cent of the diseases of the sinus are brought about in this way; but, as noted above, our series fails to confirm this. It is true that the majority of the abscesses that develop point and break into the oral cavity. When the investing tissues of a tooth become so infected, the osteogenic function of this region is stimulated to renewed activity, with the result that new bony tissue is produced. This was observed in several places where the teeth had been lost by the abscess of the bone proper, apparently protecting the sinus from invasion.

Careless operations by the dentist, such as drilling through the tooth and floor of the sinus, or forcing the root of a tooth into the sinus, through the fracture of the wall in an unskilful effort to extract, sometimes cause infection of the sinuses. The observations made would indicate that, when upper molar teeth are extracted, a great deal of care should be taken when the sinus is large and dips downward and inward between the roots of the teeth. If undue force is exerted, not only the tooth, but also a portion of the floor with other teeth attached, are liable to be removed. The majority of these accidents usually occur in the second and third molar region, including the tuberosity, and we have observed, are generally brought about through the presence of a large sinus with thin walls, as the tuberosity is quite porous in many maxillae, resembling in structure the mastoid cells. The tuberosity in many specimens does not have the pterygoid process of the sphenoid bone supporting it; which certainly weakens it greatly. The specimens we examined in which the tuberosity was well supported by the pterygoid process numbered nineteen, a minority. (Where the roots of the teeth are so closely associated with the maxillary sinus, it would not seem out of the way to say that, when the maxillary sinus is diseased from some cause not associated with the teeth, there may be a disturbance in the roots of the teeth, as their blood supply passes along the floor of the sinus and its walls. The nerve supply also accompanies the vessels, and thus paroxysms of pain may be produced.)

PATHOLOGY

The pathologic change found in our series was very high, amounting to 58 per cent, and it can be said that the disturbances observed show that it was very marked. More than half of the sinuses examined showed some form of pathologic change. The conditions ranged from thickened membranes to mucous cysts of various sizes. There were three hard tumors, ranging in size from that of a lima bean to that of a cherry. Microscopic sections proved that these were adenomas. It was noticed, after the removal of the soft parts from the sinuses, that each one of the diseased sinuses had deposit of sclerotic bone, and this was greater in those specimens presenting the most marked pathologic alteration. The walls that were covered with this new bone were much thicker, very irregular and rough. In all probability, this formation retarded the hollowing out process in this particular region, as we compared the different walls in the other parts of the same sinuses. The accessory sinuses, which were casually observed, had their share of diseased soft tissue and deposits of sclerotic bone. In all the maxillary sinuses examined, there appeared very small sharp osteophytes scattered about the surfaces of the different walls.

Of the twenty skulls of which both sinuses were examined, six showed no pathologic condition on either side; eleven, a pathologic change on one side only. It is also noteworthy that the presence of pathologic change on one side was in most cases accompanied by disease on the other side.

CONCLUSIONS

1. The major variations of the maxillary sinuses are infrequent. Those in our series were one vertical antero-posterior complete septum, and two well developed infra-orbital sinuses. The infra-orbital canals varied, in their course, from a groove to a tube in form.

2. The floors of the maxillary sinuses were below the floors of the nasal fossa in 93 per cent of the specimens, and establishment of an artificial opening through the inferior nasal meatus would not permit the most dependent drainage for the sinus.

3. Some writers have claimed that the tooth having the closest relation to the sinus is the first molar. In this series, we found it to be second molar; while the first molar ranked second, and the third molar third. We found in many instances that the ostium maxillare was tubelike in character, and was lying in a vertical position and situated in the floor of the hiatus semilunaris.

4. Pathologic conditions, especially inflammatory lesions, were of frequent occurrence, reducing the size and modifying the form of the sinus. Mucous cystic formations were very common. Three adenomas were found in as many different sinuses, and in individual heads. Sclerotic bone was in evidence where pathologic change existed in the sinus. The accessory ostia were located in pathologic sinuses, which we believe were the source of these openings. Alveolar abscesses occurred in 25 per cent of the series, but in only one of this group was there sinus inflammation or an abscess which could be ascribed to the tooth infection. When pathologic change was found in one sinus, in most cases there was also a pathologic condition in the other sinus.

5. The frequency with which fracture of the molar teeth and tuberosity involves the sinus can be explained by the

presence of thin walls and a porous tuberosity, and the lack of support of the pterygoid process of the sphenoid bone.

6. The capacity of the maxillary sinus is variable. When a pathologic process is present, the sinus is smaller than in normal conditions. In most cases, the left sinus is probably somewhat smaller than the right sinus.

DISCUSSION

George H. Wright, Boston, Mass.: Considering the small number of specimens he has examined, Dr. Boyne has done heroic work. With less than fifty specimens, he has been able to show a range and classification that is most generous and indicative of most painstaking care and work. The maxillary sinus, as a matter of fact, varies so much that it is composed of a combination of every geometrical figure that one can conceive of. It extends from the third molar anteriorly at times to the lateral incisor. The practical point for us as clinical operating technicians to bear in mind is that the variation of the floor may be from zero (almost the thickness of tissue paper) to 1 inch in thickness, and there is a large variation in thickness in the naso-antral wall, where we have the attachment of the lower turbinate. If an operator thinks he can go through to the maxillary sinus for drainage very easily, through the alveolar process tooth socket, he is mistaken. Consequently, we must be careful to be well oriented radiographically and as regards interpretation of our tissues before we attempt to go into the antrum. We must be careful also, if we are obliged to go in the antrum, to see where we are going and how we are to avoid destroying the nutrition of the teeth, because the teeth may be free from cavities and free from crowns and bridges, and to all appearances vital. It is necessary to examine teeth three to six months after operation in the region of the canine fossa, to determine the vitality of teeth, because the pulps may be destroyed and secondary infection follow, which it will defy the most careful diagnostician to discover. If we go into the antrum, it is essential that we establish drainage, not via the mouth, except as a temporary procedure, but through the naso-antral wall, below the lower tubinate. We should not touch the lower turbinate. We should leave that to function, and not destroy the epithelial surface of the nasal fossae. We should also be very kind to the tissues within the antrum. A curet should never be used except on special occasions, because if we destroy the mucosa of the antrum, we have nothing left but the basal membrane, which leaves the maxillary sinus subject to recurrent disease later in life. We should remove polypi with dry gauze. I have in my collection more than 150 antrums showing variations in the size, form and shape. Be sure that you have made the correct diagnosis as to teeth and latent infection in the bone surrounding the teeth. Although teeth may be removed, be kind to the tissue; establish drainage in the nose via the canine fossae and not via the mouth, and close the opening from the mouth to the antrum as quickly as possible.

Dr. Boyne (*closing*): All I can add is: Watch the third molars. Sometimes they "slip up" on you.

PREVENTION IN DENTISTRY*

By ARTHUR D. BLACK, A.M., M.D., D.D.S., Sc.D., Chicago, Illinois

PROGRESS in prevention of disease increases the demand and opportunity for service, in immediate and related fields.

The ideal of each group, engaged in any branch of the healing art, should be to understand the diseases in its field so thoroughly that they may eventually be prevented. This statement suggests that the dentist should endeavor to prevent entirely the diseases he is called on to treat, and thus leave himself high and dry on the altar of self sacrifice, depriving himself of the means of earning a livelihood by killing the goose which lays his golden egg. Such a course of action might appear to be a most unselfish renouncement of the ordinary interests of life and family and to constitute a heroic sacrifice, comparable to the devotion of those who consecrate their lives to the affairs of the spirit, and forego the pleasures and relationships of the material world.

Paradoxical as it may seem, the history of the development of medicine shows that, for every advance step toward prevention, and for every betterment in service which helped to ameliorate disease, the field was broadened, the service modified and the demand for service increased.

*Read before the Section on Preventive Dentistry, Materia Medica and Therapeutics at the Sixty-Seventh Annual Session of the American Dental Association, Louisville, Ky., Sept. 22, 1925.

PREVENTION IN MEDICINE

When Jenner, in 1796, introduced vaccination to create immunity against smallpox, he established a biologic principle in preventive medicine which resulted not only in the saving of untold human lives, but also, as the years have passed, in the expenditure of millions of dollars and the employment of thousands of physicians and research workers in the field of immunization, in addition to the general demand for the physician's services in vaccination.

Pasteur's proof, in 1847, that fermentation was caused by micro-organisms, and his later discovery of many isolated bacteria, together with Virchow's work on cellular pathology, published in 1858, opened a field for investigation of disease the bounds of which are even today beyond estimation. The closely related work of Lister, in the introduction of antiseptic surgery in 1867, laid the foundation for almost everything that has since been developed in the surgical field.

The discovery of the typhoid bacillus by Ebarth in 1880, followed by the recognition of this organism in drinking water as a result of sewage contamination, had much to do with the development of city, state and national departments of health. All such departments, employing thousands of engineers and physicians, are the result of medical research. It is not too far

fetched to cite the Chicago drainage canal, with its multitudinous complexities, apparently involving the health and commerce of the most populous portions of the United States and Canada, as an example of the broad application of discoveries for the promotion of health.

In 1881, it was proved by Reed, Carroll, Argamonte and Lazear that the mosquito is the intermediate host in yellow fever. This not only resulted in the practical eradication of that disease, but also made possible the building of the Panama canal, for without the work of General Gorgas in controlling the mosquito, our efforts at canal construction would have failed, as did those of the French, because of disease.

These citations are not made for their historical interest, and they may not represent the most important discoveries in medical research. Certainly hundreds of others might be mentioned. It is desired to stress the point that the ideal for prevention of disease is not so altruistic as some appear to think. It brings us back to our first statement that progress in prevention of disease increases the demand and opportunity for service in immediate and related fields.

LABOR-SAVING MACHINES

Many inventions have brought about similar results in the industries. The machine for weaving cotton cloth, the coal-mining machine, the twine-binder and hundreds of others have increased manyfold the productivity of each laborer, with enlargement of the establishments which build the machines. The men whose energy the machine replaced were promptly fitted into some other niche in the larger program, for all such improvements have resulted in so much expansion that many more men were employed, not only in carrying on the original type of work, but also in the manufacture of the machines. The progress of American industries has become the envy of the world, because of the inventive genius which has made the machine do the work and at the same time continually employ increasing numbers of both natives and aliens. In this process the American laborer has generally shifted from the place of day laborer to expert, and the immigrant has taken the place of the day laborer. As time has passed, these men have in turn stepped upward.

Nothing makes an American abroad more appreciative of the fact that he is an American than to see the patient, hard working peasants tilling the field and reaping the harvest by hand; or to note the excessive amount of hand labor that is employed for almost everything that is done in this country by machinery.

In passing, it might not be amiss to call attention to the fact that laborers have generally opposed the introduction of labor saving machinery, because they feared they would be the losers. Their attitude is not different from that of professional men who fear that success in preventing disease may result in loss of practice. That never has been so in medicine, and it will never be so in dentistry.

SCIENTIFIC STUDIES OF DENTAL CARIES

Dental caries is prevalent in the mouths of more people of all ages than is any other pathologic condition. The incidence of dental caries has been increasing with advances in civilization. Its effects on the general health are doubtless more far-reaching than we realize. Chronic mouth infections, irregularities of teeth and inflamma-

tions of the investing tissues resulting from extraction, etc., are in large measure secondary to caries. It is, therefore, of the greatest importance that studies of more basic nature, which will delve deeper into the biologic problems involved, be undertaken and prosecuted vigorously, to the end that this question shall eventually be solved.

If we were to review very briefly the efforts which are most outstanding in the study of dental caries and its prevention, we might cite the theory of Fox[1] and Bell[2] (1803-1835) that decay was an inflammatory process beginning within the crown of the tooth.

Next came the theory of chemical dissolution of the teeth, advanced by Robertson,[3] Magitot[4] and others (1835-1875), which marked the first milestone in our knowledge of dental caries. Robertson was the first investigator to classify definitely the points of beginning decay, as we know them today. He also noted the fact that the structure of enamel and dentin was different from that of bone and governed by different laws.

Then came the chemicoparisitic theory of Leber and Rottenstein[6] (1873), Milles and Underwood[7] (1881), followed by the wonderful work of W. D. Miller,[8] which extended over a period of years. Miller explained and demonstrated *in vitro* the process by which an acid formed by micro-organisms dissolved the calcium salts of the tooth and gradually produced a cavity. This marked the second milestone in the study of this problem.

Next came the report of investigations into the physical characters of the teeth by G. V. Black[9] (1895), which showed a variation of but 4.67 per cent in the calcium salts of teeth from persons of wide range as to age, suceptibility, immunity, etc., and justified the conclusion that the structure of the teeth, aside from faults in coalescence of the lobes of the enamel (pits and fissures), has no relation to the occurrence of caries. These studies were first attacked and soon afterwards confirmed by Charles Tomes,[10] of England. This was the third milestone. This series of articles included the promulgation of the principles of extension for prevention of the recurrence of decay, which are in general practice today.

1. Fox, Joseph: The Natural History and Diseases of the Human Teeth, London, 1814.

2. Bell, Thomas: The Anatomy, Physiology and Diseases of the Teeth, London, 1835.

3. Robertson, William: Practical Treatise on the Human Teeth, London, 1839.

4. Magitot, E.: Treatise on Dental Caries, Trans. by Thomas H. Chandler, Boston, 1878.

6. Leber and Rottenstein: Dental Caries and Its Causes, Trans. by Thomas H. Chandler, Philadelphia, 1883.

7. Milles and Underwood: An Investigation into the Effects of Organisms upon the Teeth and Alveolar Portions of the Jaws, Brit. Dent. J., 3: 11, 1882.

8. Miller, W. D.: The Agency of Acids in the Production of Caries of the Human Teeth, Etc., Dent. Cosmos, 25: 337, 1883; The Etiology of Dental Caries, Independent Practitioner (Dental), 4: 260, 301, 431, 496, 629, 1883; Fermentation in the Human Mouth, Independent Practitioner (Dental), 5: 57, 113, 225, 281, 339, 1884.

9. Black, G. V.: An Investigation of the Physical Characters of the Human Teeth, Etc., Dent. Cosmos, 37: 353, 1895.

10. Tomes, Charles S.: Dr. G. V. Black's Conclusions Reviewed, Internat. Dent. J., 18: 781, 1897.

J. Leon Williams[11] (1896) contributed his studies of the pathology of enamel, in which he stated that caries was the result of acid acting continuously on a particular spot in a manner impossible by free acids in the mouth. This led to the demonstration of the gelatinous plaque, described by both Williams and Black, and apparently settled two questions: first, that acidity of the saliva has nothing to do with dental caries; second, the acid which causes the beginning decay of a smooth surface of enamel is confined under a gelatinous plaque, which prevents it from being mixed with the saliva. This marked the fourth milestone.

THE ENVIRONMENT OF THE TEETH

There seems to have been a general agreement, from the time Miller's discovery of the production of caries by acid forming organisms to the present day, that organisms which produce acid are continuously present in all mouths. We can then only harmonize our clinical observations of wide variations in susceptibility and immunity with the foregoing studies by recognizing differences in the environment of the teeth, which must account for the conditions that make possible the formation of the gelatinous plaque. If there is no material difference in the calcium content of teeth of young and of old people, or of the teeth of persons who are susceptible and those who are immune to decay, we must find the cause of decay in the environment of the tooth.

We very naturally suspect the saliva of holding the secret of this complex problem. During the period from 1900 to 1915, many studies were made of the saliva to determine if possible a factor which might be accountable for susceptibility and immunity to caries. Some progress was made, particularly by Michaels, in investigations of the salts which might be crystallized out of the saliva, and by Gies, Low and others, who studied the presence of the sulfocyanids in the saliva, yet definite results of practical application were not attained.

STUDIES OF DIET

During the past ten years or more, attention has been focused on studies of diet in relation to caries, by McCollum,[12] Grieves,[13] Howe,[14] Mellanby[15] and others. All have attacked the problem with the same objective, to demonstrate variations in the structure of the teeth, produced by deficiencies in diet, which will account for increased susceptibility to caries. While these studies have demonstrated much of great value in the selection of foods which will promote good general bodily metabolism, and prevent certain vitamin deficiency diseases, the problem of dental caries remains unsolved.

There is much evidence to suggest that the means of preventing caries may

11. Williams, J. Leon: The Formation and Structure of Enamel, Dent. Cosmos, 38: 101, 1896.

12. McCollum, E. V.; Simmonds, Nina; Kinney, E. M., and Grieves, C. J.: The Relation of Nutrition to Tooth Development and Tooth Preservation, Bull. Johns Hopkins Hosp., 33: 202 (June) 1922.

13. Grieves, C. J.: A Preliminary Study of Gross Maxillary and Dental Defects in 300 Rats on Defective and Deficient Diets, J.N.D.A., 9: 467 (June) 1922.

14. Howe, Percy R.: Diet as Related to the Prevention of Mouth Disease, J.A.D.A., 10: 755 (Aug.) 1923; Some Experimental Effects of Deficient Diets on Monkeys, J.A.D.A., 11: 1149 (Dec.) 1924.

15. Mellanby, May: The Relation of Caries to the Structure of the Teeth, Brit. Dent. J., 44: 1, 1923.

be found through studies of diet; for we know that the incidence of caries has increased with our higher civilization and food complexities. The Esquimo was free from dental caries before contact with civilization. The Maori and other tribes of the South Seas are generally immune to caries today. With the belief that the environment of the tooth controls susceptibility and immunity, it is suggested that it will be worth while to carry on extensive studies to determine the effects of various diets on the saliva.

QUESTION OF METABOLIC CHANGES IN ENAMEL

The recent studies of diet necessarily presuppose metabolic changes in the enamel, and practically all evidence at hand negatives the probability of such changes. The recent studies of Williams[16] (1922) carry us back twenty-five years, and reestablish on a more solid foundation, the fact that the enamel of the tooth is entirely passive after it is built, and the structure of the teeth, as far as the calcium content is concerned, is so nearly constant as to eliminate this factor; which compels us to look again to the environment—the saliva.

It is true that in recent years the permeability of the enamel has been demonstrated; also the presence of an albuminous organic matrix in the enamel by Boedecker (1920) and later by Malleson (1924). There is, however, no evidence that this organic matrix has any relation to the problem of dental caries. Evidence at hand points definitely to the contrary. The mottled tooth, which presents histologically the same picture as a tooth the enamel of which has been partly decalcified in the process of decay, is reported by all (Black,[17] McKay,[18] Williams[16]) who have studied this condition clinically to be no more susceptible than normally formed teeth. These teeth, often so defective in structure as to be chalky in the surface areas of greatest liability to decay, present one of the strongest arguments in support of the statement that the calcium content of the enamel has no important relation to this problem. Williams has recently called attention to the fact that there is no effort on the part of the mottled tooth to better its condition by metabolic changes.

Williams also suggests that we may possibly make use of the permeability of the enamel by impregnating it with a "buffer," which would prevent the action of acid on the calcium salts. If there were available a substance similar to silver nitrate, which would not discolor the tooth, areas of liability to caries might be treated so that they would resist the action of the acid.

Dr. Gies recently reported an interesting experiment with a litter of puppies. One was injected with trypan blue, which is readily water soluble, during the entire period of the formation of the enamel; others were injected for shorter periods. The entire enamel of all of the teeth of the first mentioned puppy was blue, and that of the others was blue in areas formed contemporaneously with periods of injecting, the balance being normal in color.

16. Williams, J. Leon: Disputed Points and Unsolved Problems in the Normal and Pathological Histology of Enamel, J. Dent. Res., 5: 27, 1923.

17. Black, G. V., and McKay, F. S.: Mottled Teeth, Dent. Cosmos, 58: 129, 477, 627, 781, 894, 1916.

18. McKay, F. S.: Mottled Enamel, Etc., J.N.D.A., 6: 363 (April) 1919.

All of the tissues of each of these animals were blue during the period of the injections, and all tissues *except the enamel* cleared to normal almost immediately after the injections were discontinued; but the blue enamel remained throughout the lives of the several dogs, one of which is still living and is now 9 years old. The enamel alone was lacking in any process of metabolic change which would carry away the readily soluble trypan blue.

PREVENTION BY CLEANLINESS AND MECHANICAL MEANS

There have been numerous efforts to prevent decay by mechanical means. One of the early attempts was made by Robert Arthur (1871),[19] who observed that proximal decays always began a little to the gingival of the contact point, and therefore advocated the use of a file to cut away the contact. This method was rather extensively practiced for a few years, until inflammations of the peridental membrane and "gingival third" decays on proximal surfaces gave convincing evidence of the error.

About twenty-five years ago, the campaign of oral prophylaxis, so-called, was championed by D. D. Smith and others, as a means of preventing caries. This treatment consisted of frequent cleanings by the dentist. We have had ever and again the "clean tooth never decays" campaigns, in which our youth have been taught to brush the teeth as a means of preventing decay. While we recognize clearly the prophylactic value of cleaning, everyone should know that the best and most complete cleanliness that may be practiced by patient and dentist combined will not prevent decay in the mouths of very susceptible persons. All procedures for better cleanliness should be classified as measures which, in the broadest view, will assist in controlling decay.

All mechanical procedures should be similarly classified. The grinding of shallow pits and fissures to smooth contours, the use of copper cement in similar defects, the placing of fillings, the practice of extension for prevention in cavity preparation, are all methods of controlling rather than of preventing caries. All of these, also the mouth care by the patient and the cleanings by the dentist, have prophylactic value; but no one of these methods, nor all combined, can solve the problem of preventing dental caries.

DENTAL RESEARCH PROBLEMS, OTHER THAN ON CARIES

To many, the question of chronic mouth infections in relation to the general health would seem to be a more important problem for research than that of dental caries. Possibly it is; yet the question of chronic mouth infections would be very largely solved if dental caries could be prevented. However, neither of these important problems can be eliminated from daily practice for many, many years. If we knew the complete answers to both today, it would probably require a lifetime or more to educate the members of the profession and the public to make satisfactory application of that knowledge.

We will not undertake, in this paper, a discussion of the researches on chronic mouth infections, further than to call attention to the fact that the large majority of studies in this field have been directed to the relationship between the mouth lesions and supposedly related systemic conditions. The profession

19. Arthur, Robert: Prevention of Decay of the Teeth, Philadelphia, 1871.

has been so overwhelmed with this relationship and the almost wholesale extraction of teeth in the treatment of or as a protection against secondary disease that too little study has been given to the means of preventing chronic mouth infection.

Dentistry needs above all else a number of men trained to carry on original dental research in medical science laboratories, particularly in chemistry, physiology, histology, bacteriology and pathology. Studies of the saliva and blood; studies of diet in relation to the saliva; studies of variations in saliva in relation to the growth of micro-organisms; studies of the saliva in relation to deposits of calculus and those in relation to calculi in the gallbladder, kidney and elsewhere; studies of the pathologic changes in the investing tissues of the teeth, particularly in pyorrhea and alveolar abscess; studies of mouth foci in relation to the general health and also to specific lesions elsewhere in the body; studies of the relation of the endocrine secretions to dental caries; all of these are important problems for dental research which await the trained men, the facilities and the money which are necessary for their solution.

WHAT DENTAL SERVICE SHOULD BE TODAY

Twenty-five years ago, dentistry was a wonderfully developed highly technical calling, with its knowledge of the medical sciences, upon which an understanding of health relationships might be based, a very indifferent factor. Today and for the future, the successful practice of dentistry should be primarily a health service based upon a knowledge of the medical sciences, while it should, at the same time, maintain its high technical development as a subsidiary service.

Dental caries should be much better controlled than it is today. We are not using the means at hand to the best advantage, either in private practice or as a community service.

PRIVATE PRACTICE

In private practice, it is of the greatest importance that every attention be given to the teeth of children. The more one studies the possibilities of the control of caries, the more one appreciates the need of the care of the deciduous teeth and the first permanent molars in establishing a fair degree of immunity early in life. In this connection, a child's mouth should be thought of by the dentist as a physician considers the child's general health. If a child has the best of care as to air, light, food, etc., during its early years, it will, on the average, be less likely to contract and better able to combat disease than a child reared under conditions which do not enable it to build up a good resistance. The child who has had measles, whoopingcough and scarlet fever is likely to contract other diseases because of lowered resistance. The same general rules apply to the mouth: an earlier immunity or partial immunity to caries may be established as a result of the most thoroughgoing program of cleanliness, close watchfulness for beginning decay and prompt reparative service. The means of promoting early immunity are simple; the failure lies in the lack of appreciation of the biologic relationships—a lack of understanding of the processes by which Nature does things when she has the opportunity and a little assistance.

Several years ago, at a meeting of the officers of the sections of the American Medical Association, outlines were presented of the programs for a forthcoming meeting. For each section, there was a program arranged for a group practicing one of the specialties of medicine. When the reports were all in, Dr. Frank Billings complimented them in general terms, but criticized the practice of medicine as a whole by asking the question: "Who is taking care of the patient?" Are we thinking only in terms of the thing at hand for the moment, or are we studying patients and tissue reactions, comparing conditions in young and old persons, and following our every treatment to know its effects? Are we considering patients for a particular series of operations or for their life-time?

It is important that we learn to estimate the susceptibility and immunity of each patient, and vary our technical service accordingly. We should know the physical properties of the various filling materials and our own ability and limitations in their use. The most valuable service that a dentist can give a patient consists of the critical study of conditions both inside and outside the mouth, coupled with good judgment in determining the plan of procedure.

The lack of proper service is most marked today in the misuse of silicate cements. They are misused as permanent filling materials, where they possess none of the most desirable qualities. There might be no objection, for example, to the use of silicate cements in selected locations, especially gingival third positions, in the mouths of elderly people who exhibit a high degree of immunity, yet it would be almost criminal to place silicate cements in the mouths of susceptible children.

Silicate cements are gradually washed away in the saliva. They do not maintain a sufficiently smooth surface to justify their use for proximal fillings, because a proper contact is not maintained. The average life of a silicate cement filling is probably less than two years, and the cavity must generally be larger with each replacement. The use of silicate cements in proximal cavities in the incisors is the beginning of a program which leads to a porcelain crown, or the loss of the tooth from alveolar abscess.

How much better it would be, for young people especially, if, on the discovery of a proximal decay in an incisor, the smallest possible cavity were prepared according to the rules of extension for prevention, and permanently filled with gold foil. When one studies these cases carefully, it is surprising how many may be filled with gold without disturbing cosmetic harmony. In cases in which the appearance of gold is objectionable, porcelain inlays should be used.

It is certainly the duty of every practitioner to study all of these things with the greatest care, to look far ahead, to think seriously of his responsibility to each of his patients, to determine the best plan of procedure for each—the plan by which, everything taken into consideration, he will be able to preserve the teeth for vigorous use in mastication, with the greatest conservation of pulps and peridental membranes.

COMMUNITY SERVICE

One of the dentist's important obligations is to his community—to the 90 per cent who have little or no dental care. He should be interested and do his share in the promotion of all matters calculated to improve the health

of the community, particularly through better mouth conditions. The best available statistics from Bridgeport, Conn., Rochester, N. Y., Boston and other cities in which the dental hygienist has had a fair opportunity to demonstrate the value of her services, indicate that the number of cavities per child at 12 years of age may be reduced more than 50 per cent as a result of her efforts. This covers the period of greatest susceptibility, and there can be little doubt that the improvement toward immunity will show increasingly better results for the remainder of the lives of these children.

If the entire dental profession would get squarely behind a movement to place well qualified teachers of mouth hygiene in the lower grades of every public and parochial school in the country, the improvement in the dental and general health of the next generation would constitute the greatest service that our profession could possibly render; and yet some dentists are so narrow minded as to oppose the placing of dental hygienists in our schools for fear that their service may in some way reduce the dentist's income.

If I were a dental promoter, engaged by the profession to secure the largest possible number of patients for the least outlay, I should ask the dentists of each community to contribute jointly a sufficient amount to employ a dental hygienist for each thousand children in the lower grades. Within a brief period of years, these specially trained teachers would have brought about a reduction of 50 per cent in the susceptibility of the next generation to dental caries, and they would, at the same time, have educated the 90 per cent of our population who do not regularly patronize the dentist to the importance of dental service; and there would certainly not be a sufficient number of dentists in this country to care for half of the patients who would seek their services.

SUMMARY

1. Progress in prevention of disease increases the demand and opportunity for service, in immediate and related fields.

2. Dental caries, the most prevalent pathologic condition, is increasing with the advance in civilization; and is an important factor in relation to general health.

3. Dental caries is a chemical dissolution of the calcium salts of the tooth by lactic acid, produced by micro-organisms.

4. The acid acts continuously or intermittently on a particular spot in a manner impossible as regards free acids in the mouth. Therefore, the acidity of the saliva is of no interest in the study of caries.

5. There is no variation of consequence in the percentage of calcium salts in teeth of persons varying widely as to age, susceptibility, etc. Therefore, the structure of the teeth (aside from pits and fissures) has no relation to the occurrence of caries.

6. The control of susceptibility and immunity to dental caries lies in the environment of the tooth, and will probably be found in the saliva.

7. Efforts to determine the effects of diets on susceptibility and immunity to caries through changes produced in the structure of the teeth are likely to fail. The effects of diets on the saliva should be studied.

8. The weight of evidence to date indicates that there are no metabolic changes in the enamel.

9. All procedures for better mouth cleanliness and all mechanical forms of treatment have prophylactic value, but should be considered as valuable agents in controlling, rather than preventing, caries.

10. The greatest need for dental research is in the medical science laboratories of chemistry, physiology, histology, bacteriology and pathology.

11. Dental service of today should be based upon knowledge of biologic factors, and we should consider each patient a case for study, and apply treatment for its effect on the teeth and health throughout the life of the patient.

12. The dental hygienist is the most important factor in the development of better community dental service.

DISCUSSION

G. A. Crise, Manhattan, Kan.: I shall discuss only one or two of the many important factors that Dr. Black has brought before us. I am a great believer in diet as one of the most important factors in general health and in the control of caries of the teeth. I live in a little city of 13,000, the location of the Kansas State Agricultural College. May I bring to you some thoughts that they are developing there pertaining to the development of bone as well as of teeth? During the past five or six years, Dr. Hughes, of the Kansas State Agricultural College Experiment Station, has been conducting experiments with various farm animals, and experimental animals, for the purpose of determining the factors which influence the utilization of calcium and phosphorus. He has found that the animal body cannot make proper use of these elements if they do not, at the same time, have an abundance of vitamin D. The improper utilization of these minerals causes rickets in young growing animals. This deficiency disease is characterized by the malformation of bones and teeth, as well as by nervous and muscular disorders. This vitamin D, which is so important in the utilization of minerals, is produced by the action of ultra-violet light on fat-like compounds found in nearly all tissues. In this way, it is produced in the skin of animals if they are out in the direct sunshine; but is not produced in the animals kept indoors where the sunshine has lost its ultra-violet light by passing through glass windows. Dr. Hughes discovered that leg weakness, or rickets, in chickens, which causes such great losses to poultrymen in the spring before they can get the chicks out doors, is due to the lack of ultra-violet light. These chicks kept inside have very poorly developed bones. It is not absolutely necessary to have the vitamin D developed in the body: it may be obtained from certain foods. The only foods that ordinarily have enough vitamin D to be considered are milk from cows that have been out in the direct sunshine; egg yolks from hens that have been out in the direct sunshine, and liver oils, particularly cod liver oil. In this connection, Dr. Hughes found that eggs from hens kept away from the direct sunshine did not have enough vitamin D to supply the needs of the developing embryo. For this reason, such eggs hatch very poorly. Eggs from these hens were found to have no value at all in preventing rickets in growing chicks and other animals. Since decayed teeth are almost sure to result from an improper utilization of calcium and phosphorus at the time the teeth are being formed, it is very important that a mother receive an abundance of both the essential minerals and vitamin D during pregnancy and lactation; and that children and young people receive an abundant supply of these essential substances during the time their teeth are developing. When one understands the condition for the proper utilization of the minerals, it is possible to control the conditions so as to insure almost absolutely that a child will develop a set of teeth which will not easily decay. I am presenting this to show you, what I am fully convinced of, that we must go back to first principles if we are to accomplish anything in preventive dentistry. In order to build a good, strong, durable building, we must have first a good foundation. You cannot do this in a day, nor can you build good, sound teeth in one generation. We have to go back to the mother if we expect to overcome the inherited tendency today of caries of the teeth. One of my patients said to me recently: "What can I do to help make my unborn child have better teeth, and what can I do to help myself?" I have no doubt that each one of you have been asked a similar question, and what has been your answer? I am a great believer in heredity. I am looking into the

faces of men today that were not born when I commenced the practice of dentistry. For fifty-three years, I have tried to study the question of cause and effect of caries. I was born in the south. I have examined mouths of hundreds of negroes, and it was a rare case that showed caries of the teeth—their teeth were perfect. Why was this? Simply because of the way they lived and their environment. I knew the kind of food they got, and the sunlight in which they lived. This, and this only, was the salvation of their teeth, as well as of their health. I want to endorse Dr. Black's thoughts relative to silicate fillings. I have a great sin to answer for, as well as being responsible for a great many dead pulps. I went all over Kansas some years ago, to conventions and elsewhere, demonstrating silicate fillings as superior to gold. This is to my discredit—I am glad that I read the results soon, and came back to my early choice, the gold foil filling. Another thing, I want to emphasize the thought of the hygienist. Kansas has not passed the law regarding dental hygienists. I think that employment of the hygienist and community service are the greatest things we can offer the children and the people at large, and I believe, if you and I go back to our practices and try to practice preventive dentistry, we should put our whole soul into it. I want to impress on your minds today that service is the greatest thing on earth and fees are the second to service. Dr. Black has given us food for thought, and as we go back to our respective homes, let us carry some reflex action, some thought, something to stimulate us to be better dentists, to be better community service men, to love our profession better and to do more for the child, the expectant mother and the community in general.

R. E. Denney, Philadelphia, Pa.: Dr. Black's epitome of the important discoveries bearing on the etiology of dental caries was illuminating, and requires no discussion. His statement that progress in the prevention of disease increases the demand for service, he has proved beyond dispute. The experience of most of us will bear out this statement. I am sure that we all listened with sympathetic interest to his earnest efforts to convince his hearers that unselfish devotion to the cause of prevention, having the best interest of the patient always first, cannot help but result not only in extreme satisfaction to ourselves, but in material reward as well. How slow the world is in learning this lesson. Preventive measures in dentistry seem to fall naturally into three phases: 1. The growing of strong teeth. 2. Efforts toward the control of dental caries by means of prophylaxis. 3. The prevention of the more serious dental defects and loss of teeth by the filling cavities while yet small. How can we grow strong teeth? The most hopeful phase of that problem is the awakened interest in diet. Since the crowns of the temporary teeth, all that part of the teeth which is later to be exposed to the actions of caries, are formed, though hidden beneath the gums, at the time of birth, it is apparent that, if the diet is to play any part in the growing of strong temporary teeth, it is the diet of the expectant mother that is of the utmost importance, and when we realize that the crowns of the permanent teeth are formed before the child enters school, it is clear that the diet of the child during the preschool period is of vital importance. Progress toward immunity from caries through the diet looms large in our hopes, but we really haven't progressed very far as yet. We know so little of diet that we become discouraged at times. Mother wants to know what can be done about Johnnie's teeth, which are decaying with such discouraging rapidity. We suggest that, to get the full value of cereals, to obtain the mineral salts he so much needs, he should eat whole wheat instead of white bread. Mother says, "Yes, Johnnie loves whole wheat bread and rarely eats any other kind." We suggest that, since we lived nearly two years on milk and grew a full set of temporary teeth, milk is a fine article of diet and that it should be an important article of his diet. Mother replies that Johnnie loves milk and drinks a glass or more every meal. We suggest that his diet should contain lots of green vegetables, uncooked if possible, and Mother tells us again that Johnnie eats plenty of salads, celery, cabbage, etc.; and when we suggest that he may unbalance his diet with too much sugar, Mother tells us that she rarely permits him to have candy and that he has very little sugar. Just when we think that we may be on our way toward solving the problem through diet, the mystery of metabolism enters to confuse us. Here is sister with wonderful teeth and Johnnie with very poor teeth, and their diet is almost identical, and the health of both of them is good; but one child assimilates one food, another finds it an irritant. What one individual finds an excellent food, another may find a poison, and thus we are still much

in the dark. Then there is the mysterious problem of heredity to further confuse us in our study of prevention. I am convinced that heredity has a greater influence on the susceptibility to caries than we realize. I have been interested in this phase of the problem for a long time, and I have observed that if both parents have poor teeth, their offspring will have teeth very susceptible to caries. If both parents have good teeth, so will their children. If one parent has good teeth and the other poor, some of the offspring will have good teeth and some poor. Then, those who have studied the problem of heredity tell us that our grandparents and great grandparents are constantly intruding their influence. We have all seen how a missing or a malformed tooth will occur in succeeding generations, and how peculiar arrangement of the teeth will be seen in the mouths of parent and child. It is not difficult, then, to see how malformation of the teeth and susceptibility to caries may be inherited also. Indeed, I feel so strongly about this that I am satisfied that a child whose parents have strong teeth will develop better teeth and be less susceptible to caries, even though no thought is given to his diet, than the child whose parents have poor teeth, no matter how carefully his diet may be planned. What then can we do about the growing of strong teeth? We can at least provide the proper diet and let Nature do her best; see that every mother or expectant mother who comes to us is instructed on diet, help her to see the importance of having a diet rich in tooth building materials during the period of pregnancy and have her see to it that her child's diet is also rich in these materials until he is at least 6 years old. Diet will not help in the formation of the enamel after that period, although it may have an important bearing on keeping the environment of the teeth normal. How may we control caries by prophylaxis? We all know from experience that we cannot entirely prevent caries, but since caries starts under bacterial plaques on the teeth, the more successful we are in brushing off the plaques, the more successful we will be in preventing caries. It may be that the acidity of the saliva is not a factor in dental caries, but certainly the acid in the bacterial plaques is, and the more alkaline the mouth, the more successful we will be in its control. It has been my habit for the past two years to recommend to all patients markedly susceptible to caries the use as a tooth powder, to take the place of all other dentrifices, sodium bicarbonate, and the results have been so satisfactory that I am convinced that it is a real help in the control of caries. In mouths in which I am accustomed to find three or four cavities every six months, I have found one or none at all, and there is a lessening in the tendency for green stains to form at the necks of the teeth, which we so often find in the mouth of this class of patients, and while I regard as of first importance in the prevention of caries the development of the teeth to such a point that pits and grooves are largely eliminated, I feel that the environment of the teeth is a very important factor. We have all seen that children are more susceptible to caries than adults, and that women are often more susceptible during pregnancy. The teeth do not change: their environment changes. So, it is highly important to keep the environment of the teeth alkaline or neutral, and sodium bicarbonate is a very efficient preparation for this purpose. Now, as I have said, I do not wish to be understood to minimize the importance of a correct diet as a means of preventing caries. This field of investigation is full of promise. If our diet will help us to grow strong teeth, our problem is more than half solved. But, the tenacity with which we cling to the things that we like to eat, and the great trouble that some people go to to get some of the things that they like to drink, convinces me that the problem of caries will not be entirely solved in our day by a corrective diet. Let me say further, so that what I may say later will not be misunderstood, that the greater the care the mouth is given, the healthier it will be. The cleaner the teeth are, the fewer the cavities that will develop. But in spite of the increased interest in the teeth and the greater care given them, dental caries continues to develop with discouraging frequency. There is no dentrifice, no matter how extravagant the claim of the manufacturer, whether they dissolve the films with acid, digest them with pepsin, or wash them off with soap, that will prevent all decay of the teeth. There is no toothbrush, no matter how skilfully fashioned, that will remove all bacterial plaques. There is no mouth wash, no matter how scientifically compounded, that will kill all cavity forming bacteria in the mouth. And that leads me to the one point which I wish to stress, and about which I feel there is no doubt: The surest way for

us to prevent the more serious dental troubles, the large fillings, crowns, the destruction of the pulps of the teeth, abscesses and the chain of troubles which they may cause, and finally the loss of the teeth themselves, is to educate the public to the importance of regularly and conscientiously visiting a careful dentist at least every six months and having all the cavities filled when they are small. I know of no other sure way.

Dr. Black (closing): I will confine my discussion to three points. First, a word regarding heredity. Certain laws have been worked out by men who have made studies of the problems of heredity, which point to the establishment of two rules: (1) hereditary traits are more likely to appear in the grandchild than in the child; (2) the hereditary traits are most likely to be transmitted from mother to son, and from father to daughter, with the prevalence in favor of transmission from the mother. There are many more cases in which the transmission is from the mother. Regarding the building of bone and teeth, there is the widest variation in the effect of diets which would either add to or take from bone, as compared to the teeth, and that is just the thing that so many have overlooked in their studies of diet in relation to the structure of the teeth. When the teeth are once formed, there are apparently no metabolic changes in the teeth by which the changes may be effected that occur in bones from various known diets. Much has been said about the feeding of mothers during pregnancy to be certain of a good set of deciduous teeth for the child. I agree that the best of care and the best of food will naturally be likely to assure the best health for the child. It is a peculiar fact, however, that we see so many cases of atrophied teeth—defectively formed *permanent teeth* as a result of malnutrition during the period of formation of those teeth, and yet we have almost never found a corresponding defect in the *deciduous teeth*, regardless of the physical condition of the mother during that pregnancy. What relation this may have to the dental phase of the diet problem during pregnancy, I don't know; but it is an observation that should be kept in mind. It suggests a provision of Nature by which the mother's health may be sacrificed for the benefit of the child.

We must remember in all of these nutritional studies that the structure of the teeth is affected by conditions of malnutrition only during that period in which the teeth are being formed, and that human teeth, which are not continuously growing teeth, cannot be affected by changes of diet after they are once formed, because there are no metabolic changes in the enamel.

One purpose of this paper was to call attention to the fact that much of the research work in diets in an effort to change the structure of the teeth has entirely ignored what seem to be well established facts relative to the stability of the structure of the human teeth, particularly the enamel, and to suggest that the effect of diets on susceptibility must be found through different channels.

LESIONS OF GUM TISSUES AND THEIR RELATION TO VASCULAR HYPOTONUS*

By CLYDE M. GEARHART, D.D.S., Washington, D. C.

ONE of the elementary facts which the student learns concerning the pathology of inflammation is that fibrous tissue is the mortar and cement of the body; that it fills up gaps when tissue is destroyed; that it is extremely vascular at first, and later, through its power of marked contractility, becomes deficient in blood supply; and that this property is more marked proportionately to the amount of fibrous stroma originally in the involved tissue or organ.

The gums, by their very nature and functional integrity, must contain enough tough compact fibrous tissue to resist ordinary trauma without the production of severe reaction in their constituent tissues. It follows that such a tissue must possess to a remarkable degree the power of contractility. The extremely fibrous, but also extremely vascular, alveolar sheath which envelops the root of the tooth and is continuous with the periosteum of the maxillae as well as with the structure of the gum tissues themselves is the carrier of a liberal blood supply to the gingival and periosteal tissues with which this sheath establishes contact. But let this blood supply be suddenly interrupted, as in the case of tooth extraction, and immediately the phenomenon of rapid contractility begins in the gums to a degree not seen anywhere else in the human body. It is perfectly obvious that, in the case of tooth extraction, retraction and contraction of the very fibrous gum tissues follow largely as a result of the mechanical endarteritis brought about in the alveolar periosteum through damage to the blood vessels.

MECHANICAL AND INFECTIOUS ENDARTERITIS

If, further, we consider various constitutional conditions or diseases which might cause endarteritis or local anemia and vascular hypotonus of gum or alveolar tissues, we will be struck by the coincident fact that all such conditions are also followed by the phenomenon of retraction of the gums; and we must reasonably assume that such pathologic contractility has had its stimulus in any one of a number of conditions, local or general, which may interfere with the local blood supply. Classifying further, we find the following general conditions known to the medical internist, in which gingivitis, alveolitis or so-called pyorrhea with gum retraction is frequently seen.

*Read before the Section on Orthodontia and Periodontia at the Sixty-Seventh Annual Session of the American Dental Association, Louisville, Ky., September 22, 1925.

GENERAL CONSTITUTIONAL CONDITIONS PREDISPOSING TO GUM RETRACTION

Diabetes (Especially in Middle Life).—This condition is usually accompanied by arteriosclerosis, and frequently by endarteritis of vessels of the extremities, sometimes resulting in gangrene.

Senility: Arteriosclerosis, Local and General Endarteritis.—Wrinkles are only an evidence of increased fibrous contractility, and gangrene of the extremities is sometimes seen in senility.

Severe Anemia.—General lessened tissue tone and impaired "internal respiration" cause a lessened resistance of the mouth to infection.

Asthenia.—Persons not vigorous in body build, with low blood pressure, frequently have a lowered resistance to mouth infection through their "local tissue anemia."

EXCITING CAUSES OF GUM RETRACTION

The exciting cause of most gum retraction is usually an infection with any one of the pus-producing organisms, following local irritation or injury. It is needless here to enumerate all the various agencies that may be the exciting cause of such infection—wounds from the toothbrush in too vigorous lateral brushing; neglect of teeth and collection of calculi and sordes; pressure trauma as in dental malocclusion; the wearing of ill-fitting dentures that cause pressure and irritation; unwisely managed orthodontia compelling pressure injury to the gums and alveolar membranes—any one, or more than one, of these conditions may precipitate inflammation of the gums. Once this inflammation has developed, all the phenomena of low grade inflammatory disease elsewhere in the body are seen, plus the special phenomenon of unusual contractility, seen especially in the gums. The ultimate result is tissue retraction, a perversion of a normal protective mechanism to prevent bleeding almost peculiar to gums, and dependent on the cutting off of the local blood supply.

Certain individuals develop this condition more rapidly than others. Being impressed with its frequency in persons of asthenic habits, and underweight and sedentary individuals, I asked Dr. William Gerry Morgan, of Washington, to check up the records of his patients of this type in order to find out what percentage of such individuals over 30 years of age suffered from gingivitis or pyorrhea alveolaris, and what their blood pressure readings were.

CLINICAL OBSERVATIONS ON LOW BLOOD PRESSURE

The following reports are convincing:

Dr. Morgan found that out of 275 asthenic patients with blood pressure below 110, 102, or approximately 35 per cent, were suffering from gingivitis or pyorrhea alveolaris. Dr. Morgan further stated that ninety patients out of 195, who had attained the age of 35 years, or approximately 45 per cent of those examined who presented an anemia of 75 per cent of hemoglobin, or less, suffered from retracted gums.

Dr. William J. Mallory, of Washington, in a series of diabetic patients over 30 years of age, found that approximately 50 per cent suffered from diseased gums, gingivitis or some pyorrheal manifestation.

Bone growth and tissue health in the gums are dependent to a peculiar degree, therefore, on a good local blood supply, and this fact should be considered in devising treatment.

In the postoperative, or retention, stage of orthodontia, the alveolar process has been newly formed and the gum tissues stretched somewhat to cover this new formation. The tissues are highly vascular, as in all newly formed tissue. Daily thorough massage toward the gingiva promotes readjustment without consequent retraction. Retaining appliances of the removable type are much more desirable during this period, as the teeth are more free for functional adjustment and the manipulation of massage.

TREATMENT

The removal of all causes of local irritation and the practice of intensive dental hygiene have long been advocated as prophylactic and curative measures. Dietetic and other treatment has also been lauded; but in order to get the best results, other and more specific measures must be utilized. General examination of the patient by a competent medical internist is often of the utmost importance if any predisposing cause is to be eliminated or treated. But local measures, in addition to those outlined, especially in the prophylactic field, should be specifically applied in order to increase the local blood supply. This has been appreciated for some time, but is more a theory than a matter of actual practice. Dentifrice manufacturers are already taking advantage of the newer knowledge that gum massage has a distinct, logical and peculiar field in prophylactic treatment. They, however, are attempting to capitalize on the pathologic effects of local gum ischemia by advertising tooth pastes that are to be rubbed on the gums. Needless to say, soft polishing substances are useless for such a purpose.

A good massage medium should be (1) lubricating and stimulating without abrasive qualities; (2) capable, by its nature, of causing a reaction in the gums without irritation; (3) mildly astringent; (4) pleasant and practical to use, and (5) harmless to the teeth.

The many substances heretofore recommended for this purpose, usually in powder form, are not easy to use, and some of them are injurious to the teeth and gums. I have been experimenting both clinically and in the laboratory for some time with various combinations, and I believe that something different from, yet as easy to use as, a tooth paste, and wholly pleasant in its immediate effects, is essential as an adjunct to the toilet of the mouth, if we are to attain any success in combating the advent of gum retraction. The essentials for the prevention, or at least palliation, of this condition, therefore, are as follows:

1. Treatment of constitutional predisposing causes—anemia, diabetes, arteriosclerosis, low blood pressure, etc.
2. Removal of irritating dental trauma, caused by dentures, orthodontia appliances, etc.
3. Proper dental hygiene.
4. Massage of gums and mouth tissues at least twice daily by the patient, with a stimulating, pleasant and easily used preparation, available in convenient form for public use.
5. The education of the patient by the prophylactic dentist in the proper technic of gum massage, so that finger massage of the gums will become as well established as the use of the toothbrush.

DISCUSSION

Frank M. Casto, Cleveland, Ohio: The logical and sane manner in which Dr. Gearhart has presented his subject today should to any thoughtful person be most impressive. He has divided the subject into three parts, namely, etiology, diagnosis and treatment, and what he has given us today is the end-result of research work and clinical observations extending over a long period, and his conclusions should be accepted. He has not exhausted the subject nor is the work complete. Further investigation must be made.

Dr. Gearhart states "Bone growth and tissue health in the gums are dependent to a peculiar degree on a good local blood supply, and this fact should be applied in treatment." We all should be willing to agree on this point, and add that, without a proper local blood supply, the normal physiologic processes will be interrupted. When we consider these processes incident to tooth movement, it is perfectly obvious that they must be maintained in the application and management of orthodontic appliances. There have been wide discussion and varied opinions regarding the changes in structure that occur during and subsequent to tooth movement. There also have been an equal amount of discussion and almost as many opinions expressed as to the best method of applying force. The larger group of orthodontists believe that a gentle and slightly remittent force should be applied over a considerable period, thereby promoting increased physiologic action. They believe that the health of the tissues involved during orthodontic treatment will be best conserved by the use of an appliance which interferes least with function, and which permits the teeth to have a certain amount of individual freedom. The smaller group believe in a more rapid movement of the teeth, which involves the use of an appliance through which a more definite force can be applied and which has a firm attachment to each tooth to be moved. The advocates of this method also believe that the tissues involved are kept within the physiologic laws during orthodontic interference. In the consideration of the results by the use of either method, there must always be borne in mind the relative merits of the respective orthodontists, the application and management of the appliance used and the individual reaction of the patients operated on. There has been but a meager amount of approved research work done or reported to have been done on the histologic and anatomic tissue changes, the normal and pathophysiologic action and the individual reaction during orthodontic interference. Therefore, our present knowledge is based largely upon the observations and clinical experiences of the orthodontists. Whether or not certain reported clinical results can be attributed to the proper use of one type of appliance and certain reported clinical results attributed to the misuse of another type of appliance, I cannot say, but the preponderance of clinical evidence presented up to the present time is greatly in favor of the method used by the larger group. In justice to the patients on whom we operate and in the interests of orthodontia, it is to be hoped that the question can and will soon be definitely settled. These things have a direct bearing on the suggestion by Dr. Gearhart, that unwisely managed orthodontia procedures causing pressure injury to the gums and alveolar membranes act as an exciting cause in gum retractions. It would require but a casual study of the anatomic structures with which we have to deal to convince one of these possibilities. Furthermore, far more serious results might follow the indiscriminate and unscientific use of orthodontic appliances. However, it can be unreservedly stated, and without prejudice, that the many dangers accompanying unwise, unjudicious and badly managed orthodontic treatment have been reduced to the minimum by giving proper consideration to the case before, during and after treatment, through a recognition of the limitations of orthodontia, by beginning treatment at the proper age, by exercising care and judgment during treatment and by the use of suitable appliances. In passing, I cannot refrain from saying that orthodontists are frequently charged with results for which they are in nowise responsible. Dr. Gearhart states that "In the postoperative or retention stage of orthodontia, the alveolar process has been newly formed and the gum tissue stretched somewhat to cover this new formation. The tissues are highly vascular, as in all newly formed tissue. Daily thorough massage toward the gingiva promotes readjustment without consequent retraction. Retaining appliances of the removable type are much more desirable during this period, as the teeth are more free for functional adjustment and the manipulation of massage."

The orthodontists should be cognizant of these facts and apply this knowledge to the best advantage. As a matter of fact, the massage treatment can and should be applied over the entire period of orthodontic care. It is my opinion, based upon a rather long and varied experience, that the anatomic changes incident to orthodontic treatment have become fairly well adjusted at the completion of the semiactive period, and the readjustment is not so considerable in the postoperative or retention period as was formerly believed. If this is true, surely the method suggested by Dr. Gearhart should be employed throughout the stages of orthodontic treatment. The removable type of retaining appliance has been in general use for many years, and is admirable in those cases in which it is indicated and can be used successfully. There are, however, certain things which militate against its use in some cases, although it may be indicated. There is a large percentage of cases in which the removable type is contraindicated. This is not of serious concern, however, since the orthodontists are well versed in the fundamental principles of retention and are adhering to and applying those principles intelligently. Criticism might be found in the lack of sufficient care during the retention period. The treatment outlined by Dr. Gearhart is unquestionably safe, sane and efficient, and should produce excellent results.

John L. Smeltzer, Atlanta, Ga.: Dr. Gearhart has covered quite well the general constitutional conditions predisposing to gum retraction, which beyond a doubt plays an important rôle in the treatment of pathologic periodontal conditions. It is difficult to obtain the desired results when all physiologic functions are not normal, whether the cause is a local or a constitutional disturbance producing local anemia and vascular hypotonus of gum or alveolar tissues. The streptococci and staphylococci are responsible for the onset of the infection. The streptococcus has the power to penetrate; the staphylococcus dissolves the tissues and opens a way for the accompanying bacillus of numerous types. I have based my opinion relative to the streptococci and staphylococci principally on the research work of Drs. Henrici, Hartzell, Larson and others. This has led a number of dentists to view with skepticism the etiologic relationship of bacteria and to seek the causes of dental disease elsewhere, in disturbed metabolism, etc. While it is perhaps true that mouth infections require some other etiologic factor, either a constitutional disturbance, such as diabetes, scurvy, arterioclerosis, endocarditis and stomach disorders, or a local condition, such as tartar, ill-fitted inlays, fillings, orthodontia appliances and malocclusion as outlined by Dr. Gearhart, a careful observation, experience and study of the conditions in the oral cavity and the pathologic changes in the tissues lead one invariably to the conclusion that the presence of bacteria is the important factor involved. Dr. Morgan's case histories and records are most interesting and denote excellent work, but it is my opinion that if Dr. Morgan will check back closely on his case histories of the 275 asthenic patients, he will find that 90 per cent have first suffered with periodontoclasia; hence, the first predisposing cause of the constitutional disturbance. Too much stress cannot be brought to bear especially on one allied specialty; for, after all, it holds the key to the situation—the specialty of orthodontia, one of the essential, most farreaching and vital. It is the greatest preventive and basic fundamental factor in combating periodontal disease. It also provides an efficient dental mechanism and paves the way to body development, health and longer life. It is one of the most important factors in building up mental and physical manpower. It is a face transformer and beautifier; body and mind developer; teeth and periodontium preserver; maintainer of health and prolonger of life. However, this is true only when it is applied intelligently and skilfully. It eliminates many of the general constitutional and local exciting causes—the disturbance of functions, mouth-breathing, abnormalities, malocclusion, salivary calculus, malnutrition, inefficient dental mechanism, irritation due to anatomic variations which produce imperfect coordination in the mechanical construction of the masticating apparatus, periodontal disease and mouth infection in all forms. Strange as it may seem, after all these years, the majority of dentists do not even recognize gum retraction or periodontal disease until it reaches the virulent stage, and visible pus and mobility of the teeth are detected. At this stage of the case, many of the patients will have developed a constitutional disturbance, anemia, diabetes, epilepsy, arteriosclerosis, vertigo, low blood pressure, stomach disorders, etc. I wish to compliment Dr. Gearhart on his idea of grouping both local and constitutional pre-

disposing causes before beginning treatment of periodontia, and I fully agree with him. Proper dental hygiene is most important in all cases, as is the education of the patient in the proper technic of gum massage with toothbrush or otherwise. However, at the stage of the case that usually comes under the observation of the periodontist, it requires more than proper dental hygiene and massage. When the gingival crest has wasted away and has reached the stage referred to above, there is no recourse but surgical treatment, for all the massage and brushing cannot effect a cure and restore the tissues to normal at this stage, and, of course, the correction of traumatic occlusion is also of vital importance.

F. C. Rodgers, St. Louis, Mo.: I wish to take exception to the statement that lesions of the gum tissues, in cases of hypotonus, are caused by the wearing of orthodontic appliances. In contrast to the scientific observations of Dr. Gearhart, I wish to state that my clinical experience has led me to believe that hypertrophy and proliferation, rather than atrophy, of the gingival tissues is a more probable result. Cases have come under my notice in which there is a sloughing of the tissue covering the roots of the mandibular central incisors in patients who have never worn appliances. This process of absorption of the labial surface usually progresses to a stage in which the root is entirely exposed, requiring the ultimate extraction of the tooth. I do not know of any method or remedy which will prevent or control this condition, and I would appreciate any suggestion which may be offered in this connection.

B. Frank Gray, San Francisco, Calif.: Practically all orthodontists know too little about the work of the periodontist. Dr. Gearhart made reference to certain preparations used in the toilet of the mouth, suggesting that probably a good many were deleterious. Possibly, the Academy of Periodontology has lodged protests with the Research Commission in the matter. I think that there is a movement under way to get some relief along that line. A communication from Dr. John A. Marshall of San Francisco, a research worker, requests that the Research Commission undertake an adequate review of these things. They are being advertised in THE JOURNAL and other dental publications. The question is, are they worthy or not, and I think the time has come when we all need to know the truth about them. I am only speaking at this length because I think you who are members of the Academy could exert a wide influence if you, too, put your request to the Research Commission at this time, when the members of the commission are considering this problem.

RADIOGRAPHY FROM THE POINT OF VIEW OF THE PROSTHODONTIST*

By HOWARD H. JACKSON, D.D.S., Detroit, Michigan

"If any degree of success is to be hoped for in the art of artificial denture construction, it is imperative that we have a good foundation upon which to begin construction."[1] This foundation or ridge form[2] is one of the vital factors in a successful denture. It is furnished by the patient and on it depends, to a large degree, the comfort and stability of the artificial denture. It is therefore necessary to use every means within our power to learn whether the bony supporting structures are as promising as they seem to be from digital examination, or whether they are apt to become a liability rather than an asset.

Intra-oral radiography is the only method whereby we can determine the condition of the bony structure as an index of the future comfort and stability of the artificial denture. "Disease changes in no other tissue of the body are so little understood as those in bone."[3] And it is the recognition of these changes, in the radiogram, and their intelligent interpretation that will govern the future shape of the ridge and the success of the restorations. In this discussion of prosthodontic problems, we will deal entirely with the evidence presented in intra-oral radiograms and the assistance that may be given to us by a study of them.

Too little consideration has been given to the probable condition of the patient five or ten years hence. Because the present clinical picture of the patient may be favorable, it is too frequently the custom to disregard or misinterpret the radiographic evidence, because there is but little apparent bone destruction. The result is that, when the bony supports have been destroyed to the extent that the teeth have become loosened so that they must be removed, there remains practically no ridge form upon which to erect a satisfactory artificial denture. On the other hand, if the teeth had been removed at an earlier period, the patient would have had a "beautifully contoured ridge such as is observed after years of wearing den-

1. Giffen, W. S.: Fundamentals of Prosthodontic Compensation and Service, Dent. Cosmos 66: 397 (April) 1924.

2. Nelson, A. A.: Full Denture Construction, Dent. Items Int., April, 1925.

*Read before the Section on Full Denture Prosthesis at the Sixty-Seventh Annual Session of the American Dental Association, Louisville, Ky., Sept. 22, 1925.

3. Hatton, E. H.: Histopathology of the Periapical Region, J.A.D.A., 12: 49 (Jan.) 1925.

tures where the teeth have been extracted before the bone has been entirely destroyed by pyorrhea or removed by accident or intent."[4] In other cases,

Fig. 1.—Slight thickening of the membranes at the crevices of the lateral incisors, indicating a cervical pericementitis. The crests of the septums are pointed. The crest of the septum between the central incisors is receded but is intact.

although there has been marked recession of the ridge, conditions are determined to be favorable for further periodontic treatment without imperiling the possibilities for satisfactory dentures.

Fig. 2.—Septum between the central incisors showing breaking of the crest and a beginning infiltration of the cancellous portion.

Radiography from the point of view of the prosthodontist can be divided into two groups; namely, those cases in which all or part of the teeth are in position, in other words, the preoperative group; and those in which the jaws are edentulous, or the postoperative group. Both groups require as complete and as careful a radiographic examination as do other branches of dentistry, and a true alveolar radiogram[5] is a requisite rather than radiograms of the teeth alone.

Fig. 3.—Septums receded but are slightly infiltrated.

An examination of the preoperative group will determine the condition of the septums—whether they are intact, or, if infiltrated, to what depth the in-

Fig. 4.—Septums still further receded but not infiltrated. This type would, under proper treatment, be indicated for retention without injury to the foundation of artificial dentures at a later date.

4. MacMillan, H. W.: The Structure and Function of the Alveolar Process, J.A.D.A., 11: 1059 (Nov.) 1924.

5. Pollia, J. A.: The Alveolar Radiogram, J.A.D.A., 9: 36 (Jan.) 1922.

filtration extends; the condition of the dura and pericemental membranes, and whether the cancellations are normal and uniform, more dense than custom-

Fig. 5.—Infiltration of the septums, indicating the removal of the teeth as advisable and also the removal of the infiltrated portions of the septums.

ary or of diminished texture and quality.

Observation of the condition of the septums will aid us to determine whether the condition is favorable to intelligent periodontic treatment, or whether the best interests of the patient will be served by removal of the teeth.

The examination of the septums determines the type and extent of the

Fig. 6.—Septums extending nearly to their normal height, but the infiltrative condition extending to the apical thirds. This condition is very unresponsive to treatment as a rule, and usually the best interests of the patient indicate a removal of the teeth and curettage of the infiltrated cancellous structures to below the line of infiltration.

infiltrated process, if present. We note two types of infiltration, one in which there is but little clinical evidence of disturbance, but the radiogram shows

Fig. 7.—Infiltration of the septums and in the edentulous region as well. (Compare Figure 6.)

that the crest is broken through and there is infiltration into the body of the septum, and with no evidence of resistance by the systemic forces, as is evidenced by an absence of increased size or number of threads; the other distinguished by recession of the crests of the septums, which are, however, still intact. The line of infiltration in some cases is well defined, and there is evidence of a resistance on the part of the

Fig. 8.—Teeth revealing but little evidence clinically of disturbance and quite firm. The loss of the supporting structures, the cortical layers and the infiltration beyond the apices may be noted.

patient to the infection or the mechanical irritation present. This class of cases, together with those in which the

septums are intact, even though receded, are generally favorable for periodontic treatment. It is the class of patient with but little clinical evidence of irri-

Fig. 9.—Extent of the recession approximately the same as in Figures 6-8 but with no infiltration of the septums. This class of case will be favorable for retention without impairment of the ridge from the prosthodontic standpoint.

tation, but a definite infiltration, unaccompanied by evidence of resistance, which requires attention from the prosthodontic standpoint much earlier than it is customarily given. It is this class of case which so frequently resists all

Fig. 10.—Crests receded but still intact.

efforts on the part of the periodontist, and which, when finally the teeth have been removed, leaves practically no ridge.

Another condition to be observed is the presence of cervical pockets. These pockets, if examined clinically, will, in many cases, reveal a well organized sac, not necessarily attached to the tooth, but rather to the soft tissues or to the bony

Fig. 11.—Crests receded and infiltrative process present. The latter condition is localized to the cervical region and there is no evidence of an infiltration into the body of the septum.

supports. Radiographically, these are not shown as anatomic or pathologic structures any more than are periapical sacs. We have, however, the evidence of structural changes in the cervical and radial regions to determine this condition. I shall not go into the histologic structures of the sacs, but we have cultured many of them and have obtained

Fig. 12.—A deeper extension of the localized irritation. The protective layer of bone-salts may be noted.

bacterial growths of pure strains. Incidentally, we have also had the same systemic reaction after their removal as we have had from the removal of periapical sacs. These sacs frequently ex-

tend for the length of the root, although, more generally, they are localized in the cervical region. If they are not removed, frequently areas of diminished resistance result, with a weakened cortical plate, causing discomfort and irritation to the patient.

Fig. 13.—A cervical pocket. This will usually be found to contain a marginal sac the retention of which would result in a loss of the cortical layer at that point, with resulting spicular formation.

Examination of the cancellous structure in preoperative cases aids in determining the bone-salt content of the jaws, as the cancelli act as braces to the cortical bone, a condition analogous to that obtaining in structural steel work. Any tendency, therefore, that will result in a weakening of the cancelli, will result in a weakening of the cortical bone, although the latter may not be apparent at the time of examination.

Fig. 14.—Apparent absence of cortical layer in the bicuspid region. Examination would show a definite but thin cortical layer. If the ridge was roughened, however, as in Figure 23, there would be a great probability of a cortical layer with enlarged spaces, with rapid absorption resulting on the placement of an artificial denture. There is a well-defined cortical layer in the third molar region.

Fig. 15.—Slight roughening of the ridge in the first molar region. When artificial dentures are worn, this area would be irritated as a result of the spiculae thrown off.

In the postoperative examination, the soft tissues, the cortical layer and the cancellous structure should be observed. In radiographing edentulous areas, it is especially necessary to show the soft tissues, because, by this means, we are able to determine the presence of spiculae within the tissues. Many instances of localized irritation occurring after the artificial dentures have been in position for long periods are due to these spiculae. These small fragments are thrown off either as a result of residual infection from retained cervical

Fig. 16.—The ridge is infiltrated and residual infection is apparently present.

sacs or from infiltrated cancellous structure which was not removed at the time of operation; or are due to traumatic

Fig. 17.—Infiltration of the ridge in the edentulous region, also around the molar. This would result in absorption.

influences of the artificial dentures themselves.

The crest of the ridge must be observed, and the variation of the anatomic structure of the two jaws must be considered, when they are examined. The cortical bone of the lower jaw is far more dense than that of the upper, and we will obtain a more definite outline of the cortical bone in the lower jaw than in the upper because of this fact. In a small percentage of cases, especially in the lower jaw, we obtain a well-defined image of the cortical layer

Fig. 18.—A firm upper ridge.

over the ridge. This does not mean that, if a well-defined cortex is not discernible in the radiogram, there is no cortical layer, but simply that it is not thick and well organized. When the radiogram shows an even crest, though the margin or cortical layer is not well

Fig. 19.—A definite cortical layer in the maxilla.

defined, it must be considered that a definite cortical layer is present although thinner than we should prefer to have it.

Serrated ridges vary from a slight roughening to very deep saw-tooth effects. The former is indicative of a cortical layer which is not evenly condensed and may even have spaces within its surface, due to infectious conditions such as are associated with infiltrated septums. It is frequently the result of insufficient removal of the infiltrated cancellous structure, and sometimes is due to the presence of retained sacs. It is also observed in cases of extensive alveolectomy. Another type of ridge

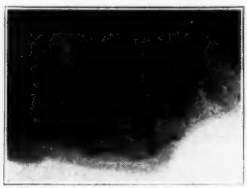


Fig. 20.—A less definite cortical layer in the maxilla than that shown in Figure 19.

shows areas of decreased density varying in size. These are almost always the result of residual infection originating from retained cervical sacs.

The last type of ridge to be noted is the knife edge, and, in this particular class, the radiographic evidence is subordinate in importance to that of the digital examination; nevertheless, these knife edges can be demonstrated radiographically, if precautions are taken, in the exposure of the film, to show the soft tissues distinctly.

The question as to what extent bone will regenerate has been clearly stated by MacMillan:[4] "The alveolus is filled in with bone up to the alveolar border. The external and internal architecture

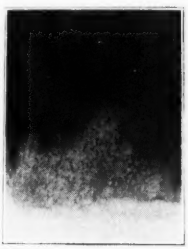


Fig. 21.—Roughening of the ridge, with a resulting local irritation beneath the artificial denture.

of the bone is constructed in accordance with engineering principles to support the adjacent teeth and gums in the act of mastication." To promote the quickest and greatest amount of cancellous regeneration as supports for the cortical layer, as much uninfected cortical bone should be retained as possible. I do not mean that the sharp serrations between alveoli should not be removed, but I am not in favor of extensive removal of either plate as long as it is normal. It is usually considered that approximately two years must pass before a socket will have filled in with normal cancellous structure. It has been a point of interest with me to observe whether this length of time is necessary. It is my observation that, if the patient is healthy and has a diet sufficient in bone-salt, approximately one year only is needed to produce a normal and firm regeneration of cancellous structure. Needless to say, retained infection or lowered systemic resistance or deficient bone-salt metabolism will necessitate a longer period of regeneration.

The cancellous structure should be observed according to the individual radiograms and also as an entirety. In the latter instance, the examination aids

Fig. 22.—A firm cortical layer in the mandible.

us in determining the systemic condition of the patient to a great extent. From the radiographic point of view, we can determine four main types of cancellous structure. The normal appears as a "harmonious blending of lights and darks,"[5] in which the spaces are irregular, with none the same size or shape. The second class shows a generalized increase in the size of the threads, but a continued irregularity of the spaces. We next determine an increase in the amount of the bone-salt content, although this has not been deposited in a normal manner; instead the spaces are more rounded. This is frequently so pronounced that a mottled appearance is produced. The fourth type shows a diminution in the size and number of

the threads, often very marked. We can enumerate a fifth type, in reality a division of the first, which reveals itself as an increase in the number of the threads themselves, without a corresponding increase in their size.

The presence of the type which is distinguished by the roundness of the spaces seems to indicate a normal bone-salt content, but faulty metabolism. This condition is also noted in localized low grade infections which are not bone-dissolving in nature.

The type in which there is a diminution of the threads in size and number

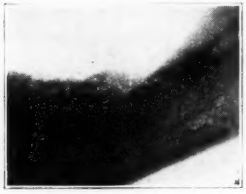


Fig. 23.—Roughening of the ridge in the mandible. This will result in a progressive absorption of the ridge.

is self-explanatory as the result of a disturbed bone-salt metabolism, which requires systemic treatment for correction. In many cases, treatment is merely a matter of diet; whereas, in other cases, the attention of a physician is required. Needless to say, reparative changes are not noticed radiographically within a short space of time. This type, especially, needs close observation by the prosthodontist, because decrease of the number of threads, acting as they do as supports, cannot but influence the outer covering, and the outer covering also will be influenced by the forces that affect the smaller structures.

Viewing the individual radiograms, we can determine whether there are localized areas of decreased density. These would indicate residual infection from some origin, resulting in a weakened cortical layer or a decrease of the supporting threads, which would eventually result in a localized irritation. There are cases, however, in which this is the result of a trauma of the artificial dentures.

The question of regenerating a satisfactory cortical layer and building up a firm cancellous support is dependent on the bone-salt metabolism of the system. If the patient is healthy and has no endocrine disturbance to affect the

Fig. 24.—Infiltration of the ridge in the lower arch, usually accompanied with irritation.

bone-salt metabolism, and there is no localized infection within the jaws, there will be a marked regeneration. In cases of deficiency, it is of no, or of questionable, value to feed calcium itself,[6] as calcium is not assimilated in colloidal, so-called ionic, form when administered in this manner. Calcium will be assimilated to the extent that it will be deposited in a nonorganic form, in which condition we notice it radiographically in the rounded spaces of "mottled-bone." Calcium alone is not sufficient; there must be magnesium, sodium, phosphorus and fluorin, as well.

6. Lewis, H. B.: Lecture before the First District Dental Society of Michigan, June 1925.

The intake of these salts is dependent on the diet and on their activation by sunlight, either direct or artificial. In the majority of cases, the cooperation of a competent physician is required in determining other factors entering into the question of bone-salt metabolism and glandular insufficiency which goes with it. This glandular insufficiency is a result of the disturbance of the parathyroid gland, as far as can be determined at the present. The influence of metal bases for artificial dentures frequently has a markedly beneficial effect.

Fig. 25.—"Knife-edge ridge," which is readily seen in the radiogram, is lost in reproduction.

SUMMARY

1. A complete radiographic examination should be made of every patient requiring artificial dentures.

2. Radiograms are a definite factor in determining when and to what extent surgical interference is indicated.

3. The character of the septums is a distinct aid in determining whether or not the best interests of the patient indicate removal of the teeth, or whether intelligent periodontic treatment will retain them.

4. The infiltrated cancellous structures should be removed with as little destruction of the cortical bone as possible, in order to promote permanence of the foundation.

5. In edentulous cases, the soft tissues should be radiographically visible in order to determine the presence of spiculae.

6. The presence of a radiographically well-defined cortical layer is rare, but a smooth, even edge is evidence of the presence of a definite cortical layer.

7. Serrated ridges are frequently the result of residual infection, due to insufficient curettage of the gingivae at the time of operation.

Fig. 26.—The "knife-edge ridge" is lost in reproduction, but in the radiogram its presence can be readily noted within the soft-tissue detail. This irritative condition would be unobserved if the soft tissue detail was not observable.

8. We frequently find serrated ridges as a result of too much destruction of the cortical layer during surgical removal of the teeth, and this is especially true in cases of patients with a lowered resistance.

9. The type of cancellous structure is of inestimable value in determining the systemic condition of the patient.

DISCUSSION

George R. Warner, Denver, Colo.: The importance of a complete radiographic examination as a preliminary step in the treatment of any mouth cannot be overestimated. Many men appreciate this in those cases in

which a majority of the teeth are still in place, but I believe that many prosthodontists and radiographers do not realize the importance of radiography as—may I say?—an integral part of denture prosthesis. I make this statement because I see many so-called full-mouth radiograms which do not include the edentulous areas. There seems to be a disposition on the part of radiographers to stress the diagnosing of tooth and periapical conditions and particularly the conditions incident to pulpless teeth. The patient may think the value of the radiogram is restricted to the depiction of what is commonly called "pus pockets on dead teeth," but surely, men who pose as specialists in radiography know better than this, and, knowing better than this, it is hard to understand why they should, for any reason, fail to radiograph all the areas that can be satisfactorily covered by the intra-oral film. The value of a complete radiographic examination in periodontoclasia is being recognized by most periodontists, but it is possible that periodontists do not recognize their responsibility to the prosthodontist. Dr. Jackson's point that hopelessly involved periodontic teeth should be promptly removed and the diseased septums removed also is well taken. I have only clinical experience to prove what I am about to say, viz., that the diseased bone in periodontoclasia does not always heal spontaneously on the removal of the teeth. I base this opinion upon the experience of having had the alveolar ridges melt away like snow in a summer sun when untreated or unsuccessfully treated periodontoclasial teeth were extracted without curettement of the diseased alveolar borders; whereas, under the present method of clipping off all necrotic borders, the ridges hold their form most satisfactorily. Edentulous areas are also prolific in retained root fragments and septic foci. One recent case yielded three septic foci from areas from which the teeth had been removed twenty years before. During the past year, we have found at least one retained root fragment or other operative area in more than 50 per cent of the edentulous mouths radiographed. I do not altogether agree with the essayist that, in the knife edge type of ridge the radiographic evidence is subordinate in importance to that of the digital examination. I have found the typical knife edge radiographically, when the soft tissues presented a fairly well-rounded ridge. That serrated ridges are frequently the result of residual infection is borne out in many cases which I have radiographed and in which I have subsequently seen operation performed and successful dentures replace failures. The value of the complete radiographic examination in determining the amount of bone salt with all which it implies, as a guide in operative procedures, as a basis for prognosing the shape and permanence of the ridge, as well as the other matters already mentioned, has been extremely well brought out by Dr. Jackson and should be conclusive in inducing prosthodontists always to demand and to depend on such an examination.

Hugh W. MacMillan, Cincinnati, Ohio: The most important step in obtaining the successful termination of a case is its correct diagnosis. In obtaining this correct diagnosis, many factors have to be taken in consideration, factors so numerous that their mere mention would consume all the time allotted for this discussion. As Dr. Jackson has mentioned various types of cancellous structure and as the correct interpretation of this cancellous structure is, after all, the whole problem in dental radiography, this discussion will be chiefly concerned with the question: What constitutes the normal cancellous structure? To approach this subject, it will be necessary to offer a new definition for that part of the maxillary bones popularly known as the alveolar process. The alveolar process may be defined as that part of the jaw bones which gives support to the teeth or their artificial substitutes, and is composed of compact and cancellous tissue arranged in its external contour and internal architecture to best meet the stresses transmitted during mastication. It may be further emphasized that the relation of opposing teeth, the length of the cusps, the different degrees in the axial angles of the superior and inferior teeth, the influence of the accessory factors concerned in mastication, and all the remaining agents, pathologic or otherwise, which may affect individual bones or the osseous system in general, are as indelibly imprinted on the structure of the alveolar process as are environmental in-

fluences on the head of the femur. The alveolar process has been described by one writer as "consisting of soft spongy bone which should be considered as practically distinct bone—its structure, function and embryology differ so completely from the structure and function of the maxillary bones." Evidently, the mechanical significance of cancellous bone was unknown to him. The following references regarding the structure, function and development of cancellous bone in other parts of the body is directly comparable to the cancellous part of the alveolar process. "Spongy bone is homogenous with compact bone as a structural material and differs from it mechanically only in possessing smaller strength approximately in proportion to its density as compared with compact bone." (Koch.) Cancellous bone is found in those parts of the body where the chief function is to transmit tensile and compressive strains. For example, in the vertebral column the most efficient method of transmitting the weight of the head and thorax is by cancellous bone. In the vertebral column, as in the head of the femur, "the trabeculae lie exactly in the paths of the maximum tensile and compression stresses, and hence these trabeculae carry these stresses in the most economical manner. This is in accordance with the well-recognized principle of mechanics that the most direct manner of transmitting stress is in the direction in which the stress acts." (Koch.) In brief, that part of the alveolar process which is composed of cancellous bone is constructed in the strongest manner with the greatest economy of material to best meet the varied forces occurring in mastication. The transition from cancellous to compact tissue around individual teeth is a beautiful record of the changing types of stress to which each part is subjected. "The thickness and closeness of spacing of trabeculae vary in bone directly with the intensity of the stresses transmitted by them." (Koch.) Here is the physiologic law which accounts for most of the varying densities in the dental radiograms. A single remaining molar bearing all the stresses of mastication is characterized by an increased closeness of spacing of trabeculae. Conversely, a decreased closeness of spacing of trabeculae is characteristic of lack of use, or disuse atrophy, of the part. These changes are not produced by infection or inflammation. They are fundamentally changes in bone due to physiologic stimulation or lack of it. To term these changes condensing osteitis is to confuse their origin. The physiologic changes in bone are no more pathologic than are more pronounced tuberosities on the humerus of a laborer. Thus, it will be seen that it is impossible to determine the significance of cancellous tissue, unless by a careful differential diagnosis of the masticating history of the individual patients. A most instructive method of gaining a true conception of cancellous tissue is in a comparative study of cross-sections of jaw bones of modern and of primitive man. In passing, it may be said that a study of this kind might alter some modern dental misconception such as traumatic occlusion, alveolectomy and other passing fancies. So much for the cancellous tissue in what Dr. Jackson calls the preoperative type. In the edentulous or postoperative type the alveolar border is subjected to stresses applied to it in a far different manner from those produced by the tooth embedded in the jaw. Instead of the forces being of the compressive, resistive and shearing type, the chief stress to be met by the edentulous mandible is that of bending. In accordance with the law of bending stress, the body of the mandible in the molar region is hollow, the bone forming the outer and inner plates, being arranged with its mass at the greatest distance from the neutral axis. The entire body of the mandible, including the part generally known as the outer and inner alveolar plates, is composed of compact bone. The alveolar plates contain all the characteristic features of compact bone found elsewhere. Histologically, it is impossible to distinguish it from other compact bone except for certain peculiarities in the arrangement of the lamellae due to its development. In the edentulous mandible, a histologic study of the cancellous tissue in cross-sections through healed molar alveoli reveals the presence of compact bone at the gingival border uniting the inner and outer alveolar plates. The transition from cancellous to compact bone in this region is a beautiful example of the adaptation of bone to bending stresses through the addition of reinforcing

lamellae to the interior of the haversian spaces, resulting in the classic haversian system. Again, the reading of the radiogram must take into consideration physiologic changes. One slight exception must be taken to the term "threads," which is used in the paper to designate the cancellous trabeculae. When one considers the function of the trabeculae of the alveolar process in combating stresses, often of several hundred pounds, and how beautifully they are arranged parallel to the maximum internal stresses, the term "threads" hardly does justice to them. Histologically, they are composed of parallel lamellae, which are often arranged concentrically around haversian systems within the trabecula. Thus, each trabecula is really a prolongation of compact bone, since it is constructed essentially as is compact bone.

Dr. Jackson (*closing*): I am glad to hear Dr. Warner stress the necessity of complete radiographic examinations. As he states, this means examination not only of regions where teeth are present but of the edentulous areas as well. This has been frequently stated by radiographers and others, but we yet find all too frequently the so-called "complete" examination disregarding the edentulous spaces. It is the attention given to all areas of both arches which governs the success or failure of accurate interpretation. The work of Dr. MacMillan in emphasizing the influence of stress on cancellous structures is the result of painstaking and thorough study and is convincing in its findings. However, observation of patients who have been referred for examination because of systemic involvements cannot but force one to realize that there are other factors entering into the problem. These can be classified roughly or generally as being the result of disturbed bone-salt metabolism. Mechanical influences alone will not produce the varying types of structural formation which one notices in patients with different types of systemic disorders. These phases of the subject require further study, I admit, but it will not be until the systemic factors are studied and classified, not only clinically and pathologically, but experimentally as well, as from the mechanical aspect, that diagnosis from the radiogram will be possible, instead of merely interpretation.

THE DIAGNOSIS OF TUMORS OF THE MOUTH*

By J. GARLAND SHERRILL, M.D., Louisville, Kentucky

BECAUSE of the large numbers of growths involving the buccal cavity, only a synopsis can be given in the allotted time. As regards neoplasms, the most important question, from the standpoint of the sufferer, is the question of malignancy. His first question is, "Have I a cancer?" then, "Can the growth be removed safely and will it recur?"

Fortunately, lesions in the oral region come to the attention of the surgeon much more promptly than in some other parts of the body, and are, therefore, treated more promptly and more successfully than similar lesions elsewhere. Yet treatment is often delayed from one cause or another until they are beyond relief.

There are a number of lesions in this region which are essentially benign and may be recognized readily as such. This class includes mucous cysts, cysts of the thyroglossal duct, ranulas, vascular growths, such as angiomas, epithelial growths of the benign type, papillomas and simple warts. Syphilitic warts or condylomas and like tumors, epulis, cysts of the jaw and similar growths may also be included in this group.

Certain other neoplasms are benign in some instances and malignant in others. Mixed salivary tumors are of this type. Polypoid masses springing from the pharynx, which occasionally reach into the mouth, are benign usually, but may become malignant.

The growths involving the lips appear as benign papillomas or warts, condylomas, usually syphilitic, also benign, or as proliferating warts of cauliflower appearance, of malignant type. Another form of cancer of the lip begins as a fissure or crack with an indurated base and a smooth surface which refuses to heal. A third type simulates leukoplakia, a flattened white patch on the mucous membrane, which may persist and terminate in epithelioma.

The benign types of warts and papillomas are painless, grow but little or not at all and show no tendency to ulcerate. The same is true of moles or nevi. Such benign structures do not show any induration of the base and have no glandular involvement. They may, if not subjected to irritation, remain indefinitely without assuming the nature of cancer. They are, however, potentially cancers and should be radically removed. The use of pastes or any kind of irritating treatment should be avoided.

Growths on the lips which continue to progress, which show induration at

*Read before the American Society of Oral Surgeons and Exodontists, Louisville, Ky., Sept. 18, 1925.

the base, ulceration on the surface and enlargement of neighboring lymph nodes are malignant. Pain is not necessary to a diagnosis, but its persistence is strong evidence of malignancy. Such growths require prompt treatment. Many methods have been employed successfully, the actual cautery, radium, roentgen ray, electric coagulation and radical excision.

Fig. 1.—Lymphangioma of the tongue.

Ulcers on the lips, the cheeks or tongue result from injury with simple infection, syphilis, tuberculosis and cancer. Each presents certain characteristics. The simple ulcer which forms from injury is sudden in onset and is slightly painful, has a smooth surface and may show a yellow coating. It tends to heal promptly after the application of phenol (carbolic acid) or silver nitrate or the use of an antiseptic wash.

Syphilitic sores are flat, painless patches, which are symmetrical on both sides of the cheek or mouth and are sensitive to heat. The edges are not high, and shelve off to the level of the sore. These lesions when secondary are always accompanied by other syphilitic manifestations and disappear promptly under antisyphilitic treatment. A chancre presents an indurated, firm base with a smooth cup-shaped surface. The discharge, which is slight, is a

Fig. 2.—Sarcoma of the upper jaw, with infiltration in the lip and bulging into the mouth.

bloody serum. The submaxillary lymph nodes on the same side are painlessly enlarged. Median chancre may show bilateral lymphatic enlargements. The Wasserman reaction is positive.

Lupus and other tuberculous lesions show a slow form of ulceration, with irregular edges, slight induration at the base and an angry surface, and a pale yellow secretion with few granulations. They bleed easily. Such ulcers extend

on to the cheek and are sluggish and slow to heal.

A malignant ulcer shows more induration at the base, and may be either painless or painful. In time, the lymph node involvement occurs, but diagnosis should not wait for this.

Tuberculosis of the tongue is quite rare, probably because of the resistance of the surface epithelium. Only a few cases have been observed. The majority accompany tuberculous lesions elsewhere, particularly of the pulmonary and laryngeal structures. This lesion may occur as an ulcer of the lupus type previously described as affecting the cheek. It may present as a nodule deep in the tongue where a typical tubercle is observed, and it is likely to be mistaken for a gumma, a sarcoma or an actinomycotic granuloma. It may persist for some time, causing little pain or inconvenience. Subsequently, it tends to caseate, soften and perforate as a cold abscess. An ulcerating sore may remain.

A form of papilloma of soft type has been observed in tuberculous cases. The more frequent type is an ulcer with irregular indurated edges, healing at one point while extending to another. As in all cases of lupus, nodulation is probably beneath it. Most cases are quite painful, but Finney was struck with the absence of great pain in his series.

Carcinomatous ulcers show little tendency to heal at any point. They are quite painful. The pain is of a persistent, burning type. They show deep, irregular, abrupt edges and have none of the tuberculization shown in tuberculosis.

Syphilitic sores on the tongue may be mistaken for cancer. More frequently, cancer is mistaken for syphilis, and the treatment is delayed unnecessarily and often fatally. The Wasserman test is an aid in diagnosis. Cancer may occur in a syphilitic with a positive Wasserman reaction. Any ulcer of neoplasm of the tongue persisting for more than three weeks under arsphenamin or mercury therapy is almost certainly malignant.

Fig. 3.—Appearance of patient after excision of right superior maxilla for sarcoma.

We are all familiar with the benign fibroma or epulis which springs from the periosteum of the alveolar process. This firm, reddish growth rarely becomes malignant, but may recur after incomplete removal. Syphilitic and tuberculous ulcers may occur over the jaw and even involve this structure, but most ulcerations extending from the mucous membrane to the bone are malignant.

Certain inflammatory affections of

the jaw produce swellings resembling neoplasms. The more rapid development, the tenderness, redness and pain, with frequently a purulent discharge, will enable the observer in reaching a diagnosis.

Tumors of the mandible show considerable variety. Some of these are simple cysts, the most frequent being of dentigerous origin, and they are essentially benign. This type of growth also involves the upper jaw. The diagnosis is made by the slow growth, the absence of pain, the crackling of the thin layer of bone covering the growth, and the absence of glandular enlargements. Aspiration will reveal their cystic nature. Clear serum usually, but not invariably, indicates a benign cyst. Bloody fluid strongly indicates sarcoma. The roentgen-ray findings make the diagnosis of a cyst positive, but the differentiation from sarcoma requires skilled reading of the plate.

Perthes, 1907, describes certain dental root cysts which arise from the roots of the teeth. These cysts are lined with epithelium, contain a viscid, yellowish mucus, and are essentially benign. They are usually small, and occur less frequently in this country than in Germany. They are probably of inflammatory origin and are preventable. The diagnosis is based upon the presence of small, rounded, painless, semifluctuant masses of slow growth, in the gums.

Fig. 4.—Appearance of patient twenty-five years after excision of the left half of the inferior maxilla for sarcoma, showing small disfiguration.

Bloodgood describes, under the term adamantine epithelioma, a type of tumor which originates in the alveolar border of the jaw. The cystic form

occurs more frequently than the solid type. Both grow very slowly, sometimes being present for many years. When thoroughly removed, they do not recur. The term adamantine epithelioma as applied by Bloodgood indicates his belief that the growth originates in epithelial tissue. They probably spring from the enamel of the teeth or from the periodontal membrane. According to Hadfield,[1] they arise from the paradontal epithelial débris. The tissue from which tumors spring "is found normally as cellular masses or primitive tubules deep in the tissue of the gum and is derived from invaginations of the gingival epithelium which go to form the enamel organ." The presence of the hard, bony structure in these growths suggests a mesoblastic origin. The salient features of these neoplasms for differentiation are their slow, painless growth, large size and great hardness.

Sarcomas occur with some frequency in the lower jaw. They develop either from the periosteum or are of central origin. The first type appears either as round-cell or spindle-cell tumors. The latter usually assumes the giant-cell type, and is sometimes called a myeloma. There is marked difference in the malignancy of the three types, corresponding rather accurately with the microscopic picture. The round-cell tumors are most malignant, the spindle-cell less so, and the myeloid or giant-cell least malignant. Some writers class the latter among the benign growths.

Tumors of the upper jaw may assume any character of growth. They are more likely to show malignancy than those of the mandible. In young subjects, sarcoma occurs most frequently, while carcinoma is observed most often in older persons. Both of these types are grave. It seems probable that the increased vascularity to some extent accounts for the more pronounced tendency to spread.

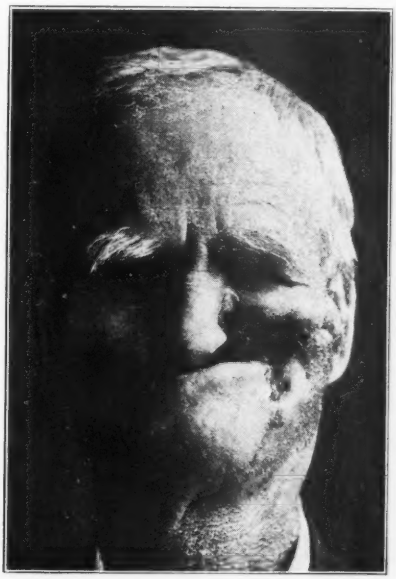


Fig. 5.—Advanced carcinoma of the upper jaw, inoperable.

The picture presented by malignant tumors of the upper jaw is quite characteristic. The development is first observed by enlargement of the jaw, either a swelling of the cheek, a bulging into the mouth or a mass obstructing the nares. In time, all of these conditions are observed. The growth in these cases is constant, and usually progressive. Considerable discomfort,

1. Hadfield, G.: Brit. J. Surg., 11: 634 (Jan.) 1924.

and at times severe neuralgic pain, is present. The disfiguration is sometimes quite marked. The diagnosis is based upon the clinical course, and character and feel of the tumor. Glandular involvement is late. Cysts of the jaw are sometimes mistaken for malignant growths. These cysts are slower of development and soon become stationary. Transillumination is of some value. The roentgen ray is the most efficient aid to diagnosis. This is particularly true in the early stages, when cure may be obtained. The extreme importance of early recognition of tumors involving the tissues about the mouth should be emphasized. The dental profession is particularly likely to meet these cases, and your duty to the patient calls for their prompt recognition.

Fig. 6.—Left: Mixed tumor of the parotid gland. Right: Appearance of patient seven years after operation.

DISCUSSION

Arthur E. Smith, Los Angeles, Calif.: When the theory was advanced that the mouth was the great gateway by which general systemic disease was contracted, little attention was given it, but as modern research developed, it has proved the transmutation and selective localization of pyogenic organisms arising from oral infection. This one time theory is now accepted as a fact, and this new accomplishment in medical and dental research has revolutionized some of our ideas of etiology, pathology and treatment. In a large measure, the credit for definitely establishing and determining the end-results of mouth infection belongs to the dental profession. Since this fact has become known, it has placed a broad responsibility on the dentist in constructing appliances and eradicating pathologic tissue, and also in educating the public as to the importance of mouth hygiene. In addition to his responsibility as regards focal infection, the dentist faces another grave responsibility in the recognition and diagnosis of neoplasms of the mouth. As Dr. Sherrill stated, the dental profession is particularly likely to meet neoplasms of the mouth, and his duty to his patient calls for their prompt recognition. Neoplasms of the jaws and adjacent tissues are common, since the jaws, oral tissues, lips and other adjacent tissues are continually subjected to trauma, irritation, tooth decay and infection. Dental decay may open thirty-two avenues by which infection may enter the bone, and the delicate first line defense, known as the gingival margin, may become diseased and permit infection to enter the body. When we consider the amount of traumatism and irritation to which the oral

tissues are subjected, such as smoking, bad dentistry, food hot and cold, abrasions, drugs and infection, is it not perfectly reasonable that a large percentage of neoplasms and infections should be primarily situated in the mouth. Dr. Sherrill is correct in stating that, fortunately, patients consult the surgeon more promptly regarding lesions occurring in the mouth than for lesions situated in other parts of the body, and are therefore treated more promptly and more successfully. Many varieties of tumors and cysts which arise in other parts of the body are found in the mouth, and in addition certain tumors and cysts are peculiar to the oral tissues. The important question which always confronts the operator and which may mean life or death to the patient is whether the neoplasm is benign or malignant. In examining any neoplasm, the surgeon should ascertain a complete history of the tumor, its time of beginning, when the slightest abnormality was first detected, its exact location, its present size, its rapidity of growth and consistency, possible trauma from decayed teeth or poor dentistry, history of injury, age of patient, presence of pain or discomfort, or deformity or enlarged glands, metastatic growth, cachexia, syphilis, actinomycosis or lupus. In addition to an objective and subjective physical examination, a careful microscopic examination should be made to determine the structure of the growth and whether it is benign or malignant. The most common forms of new growths involving the oral tissues are dental cysts, hypertrophied gums, epulis and fibroma. With hypertrophied gums, the tissues become reddened, swollen and infiltrated with fibrous tissue, a condition which may continue until the teeth are completely surrounded. This usually occurs in children and must be differentiated from mercurial stomatitis, Vincent's infection and osteomyelitis. An epulis is usually a pedunculated new growth arising from the gum at the gingival margin of any tooth anterior to the third molar. The giant-cell type, which is the most common, is soft and vascular, bleeds easily and grows more rapidly than the fibrous type. It is considered benign, but Bloodgood advises us always to regard it with suspicion. An ill-fitting denture, chronic pyorrhea, gingivitis and salivary calculus may cause this form of neoplasm. A dental cyst is a degenerative process, and the term is often used in describing an absorption abscess or dentigerous cyst. However, there is a pathologic condition that can be properly placed under this designation. Many times, a dental cyst is found in connection with pulpless teeth.

Neoplasms of dental origin are the odontomas, which include a number of benign tumors and cysts which arise from arrested tooth germs and are composed of dental tissues. Bland and Sutton have classified them according to their structural peculiarities as follicular and fibrous odontomas, cementomas, compound follicular odontomas and radicular and composite odontomas. These forms of dental tumors, which originate during the evolution of the tooth, are solid. They depend on the anomalies of the developing tooth and are formed by the hyperthrophy of the dental tissues. They occur, as a rule, in youth, more often in the lower jaw, and as a rule connected with the permanent molars. The primary cysts of the jaws are divided into dentigerous, the unilocular or the multilocular, and adamantoma. Their origin has not been definitely established, but it is thought that they may be derived from epithelial remnants during development of the enamel organ. The dentigerous cyst which is usually single and quite large occurs most frequently in the lower jaw. The term sarcoma is usually applied to nonencapsulated tumors, which attack adjacent tissues and extend to distant parts through the blood stream. The invading of distant tissues constitutes malignancy. When the epulis is included, sarcoma is the most common neoplasm of the lower jaw, and next to carcinoma, the most common neoplasm of the maxillae. Sarcoma appearing in the region of the mouth may originate from the tooth sockets, peridental membrane, periosteum, gums or antrum. In the upper jaw, it usually starts in the antrum. If it starts in the tooth sockets, it causes a loosening and loss of the tooth, and a sarcomatous mass extends from the socket. This tumor seldom causes pain in the primary stages. A microscopic examination will avoid disastrous delay. In some cases, the growth is rapid, and if early radical treatment is not instigated, death soon follows.

Carcinoma of the jaw, tongue and adjacent tissues occurs in individuals past 40 years of age. It is of epithelial origin. In the oral cavity, it starts primarily from the mucous membrane, tongue, lips, gums and palate,

invading the jaw secondarily, and metastasizing by the lymph stream. When it occurs in the mouth, chronic irritation may be an important factor. It may be associated with a syphilitic ulcer, old scars and leukoplakia. Tuberculous ulcers, syphilis or actinomycosis may be mistaken for carcinoma. Bloodgood is emphatic in stating that cancer of the mouth is a preventable disease. Cancer of the lip, mouth and tongue may attack men who use tobacco to excess or have ragged, dirty teeth. Carcinoma of the mouth always gives warning by a sore spot, a white patch or an area of irritation. The occurrence of malignant tumors of the mouth and jaws has been steadily increasing in frequency, and every effort should be made by the combined professions to decrease by such means as are now at our command the incidence of this often fatal malady. Statistics compiled by the Bureau of the Census in 1921 indicate a rise in the mortality from cancer. It showed that more than 76,000 deaths were due to cancer in the death registration area. Assuming that the death rate for cancer was the same for the remainder of the United States, the number of deaths from the entire country in 1921 was 93,000, which is 4,000 more than the number estimated for 1920. According to Dr. Bloodgood, a cure of cancer at the present time is not a drug, nor a serum, nor a ray, nor a miracle, but simply the education of the people as to the signs of its beginning and the importance of immediate treatment. Cancer is not inherited, and the fact that a man's father or mother had the disease is no sign that he will have it, and this truth is recognized by the life insurance companies. It is not contagious, and according to the records, there is not a single instance of anyone having contracted cancer by attending a cancer patient. There is no medicine or diet or serum known at present which will cure it. Its etiology is the great puzzle of the medical profession. A danger signal which the dentist can observe is the sore that does not heal within a few days about the tongue, mouth or lips, which may be the result of irritation from broken teeth or poorly constructed dental appliances. Cancer never begins in a healthy area; therefore, when a patient becomes aware of a tender spot, persisting more than a few days, he should, at once, seek the advice of his physician or dentist and ascertain whether or not it is dangerous or harmless. A white patch, a tender spot, an inflamed area, a fissure, a wart, an ulcer or any other condition which does not quickly heal, or pain in the teeth or jaws, calls for a careful examination and diagnosis. The most efficient treatment for cancer today is early diagnosis; radical surgery; the application of radium, roentgen ray or endothermy, or dessication. A patient who has a lesion of the oral tissues will, in many instances, first consult his dentist, who will at once become suspicious of any condition that does not appear normal. If the dentist is not in a position to make a diagnosis, and to assume the responsibility and render immediate treatment, he should at once refer the patient to a specialist.

E. C. Hume, Louisville, Ky.: Dr. Sherrill spoke of the treatment or delay of treatment. I have seen many cancers about the mouth in the last three years. I have records of some 230 proven malignancies of the mouth, and, in many of these cases, failure to diagnose early has resulted in many of these unfortunate individuals having lost their chance of a life of normal length. Some of these cases were operable at the time they were diagnosed, and these individuals should live out their allotted time without recurrence. We, as dentists, should be continually on our guard, watching for these lesions and warning our brother practitioners not to tolerate the appearance in their patients of any sore, crack or ulcer, or indurated surface about the mouth that does not promptly heal. Dr. Sherrill is right in his radical treatment of these tumors. There is just one of two things to be done: care properly for the condition or turn it over to someone who will. There is not time for tinkering or delay. I do not believe there is anything so effective in these soft growths about the mouth as the actual cautery. I do not hesitate to take a cautery and burn out any area that should be destroyed. I burn it out until I think I have gotten the entire growth, being sure there are no malignant cells left. In some of these instances, the patients have gone four or five years, and a few seven years without recurrence. I am sure that is the only way in which I could have gotten that sort of result. As regards the combination of cancer and syphilis, oftentimes when we get a three or four plus Wassermann reaction, we simply turn the case over to a syphilologist for treatment. We do not fulfil our full duty to the

patient if we do that. We should impress on him the fact that they should return and continue to return until we see the effect of the antisyphilitic treatment. A man, age 27, who had a four plus Wassermann was referred by me to a syphilologist for treatment. Now this man is in such a condition, due to cancer, that I doubt seriously that he has a chance to get well. As regards cysts, they are most often mistaken for malignant growths. We see a good many cysts that are easily diagnosed and easily removed from within the mouth without scar on the outer surface of the face; not only easily removed, but also removed in their entirety, so they will not return. We have seen a number of such cysts that were diagnosed as various types of malignant growths, and recommendation made that one-half the maxilla or mandible be removed by radical operation. Four or five years ago, at one of the local hospitals, a young woman presented a condition diagnosed as sarcoma of the left half of the maxilla. When called to see this patient, I found that no roentgen-ray examination had been made. Examination revealed an impacted cuspid tooth with a large cyst around it. It was easily removed from within the mouth and there has been no recurrence. I believe I am as radical as anyone dealing with any type of proven malignancy, but I do not believe we ought to jump at the diagnosis. It is easy to get a specimen to a competent laboratory man. If the patient is made to realize the seriousness of the condition, we can always find someone who will undertake the treatment of it. If you do anything at all, do the radical thing, and make sure that sufficient tissue has been removed, and in one operation, if possible.

William L. Shearer, Omaha, Nebr.: First, I want to make myself clear about certain types of tumors of which Dr. Sherrill spoke, namely, those of sarcomatous varieties coming under the head of spindle, small, round cell and giant cell sarcomas. I do not know whether Dr. Sherrill wished to convey that the recognition of this growth in the mouth meant a radical operation or not. If he did, from my own clinical experience I want to take exception to that and give records of my own work in regard to sarcomas. Sarcoma arising in the body of the mandible or maxilla is an entirely different tumor as far as the management of the growth is concerned. If it has its origin at the beginning around the cemento-enamel junction of the teeth involving the bone, a radical operation is, in my opinion, contraindicated. These tumors of which I spoke always have an attachment at the cemento-enamel junction, and wherever this attachment exists, if the particular tooth involved is not removed, these tumors return. They do not require radical, extensive incision for their removal, only incision up to the line of demarcation, both lingually and bucally. With the removal of the teeth and the gross involvement of the bone, and with care to preserve the mucoperiostium, bringing the mucoperiosteal flaps back into apposition, suturing and following with one, two or three treatments of deep roentgen-ray therapy, these growths do not return. I have on record sixty-one cases within the last twelve years without a recurrence. Deep roentgen-ray therapy is indicated rather than radium, because we avoid the burns, scarifying and contraction of tissues which so often follow deep radium therapy. This type of tumor, as I have described it, need no longer be feared. I agree with Dr. Sherrill on the radical removal of sacromas which arise in the body of the mandible and involve the whole structure of the mandible or maxilla even though the result is often deforming. I know from my own experience, which is not large, yet not small, that deep roentgen-ray therapy will control the growth of the tumor as far as the mucous membrane is concerned. Without deep roentgen-ray therapy, my experience was not unlike other men's—this type of tumor returned, and ultimately involved the deeper structures to the point of breaking down, and, later, carcinoma. In regard to the child that someone spoke of, 3 years of age, with a sarcoma developing, I certainly would not remove the whole maxilla of a child of that age, because deep roentgen-ray therapy, properly handled, will check the growth and a hideous deformity will be avoided.

C. D. Enfield, Louisville, Ky.: Dr. Shearer spoke of the scarring and the burning which follow radium treatment. Radium treatment as a phrase doesn't mean anything more than surgery as a definition. There are all kinds of radium treatment just as there are all kinds of surgery. The most interesting thing that

has been put out in recent years on radium therapy was, to me, the report of the Memorial Hospital of New York, published about a year ago, dealing with their experience with radium by various methods of application. There was a chapter on mouth malignancy in which statistics going back as far as any in this country were given. The results shown are purely from radium treatment, for the most part embedded radium. Those statistics, I believe, are a little superior to any surgical statistics that have been published. I don't think anyone will question the honesty of the workers at the Memorial Hospital. To me, the problem is this: If I have a lesion in my mouth, and I have an equal chance of having it cured with some kind of radium application, which will leave me my face as long as I can use it, as compared with having my face taken off, I am going to keep my face, the chances being about even as far as recovery is concerned. In regard to diagnosis, we have seen recently three or four mouth cases in which treatment was withheld because smears had shown the condition to be positive for Vincent's infection. Any chronic condition in the mouth is going to show positive Vincent's spirilla. This has caused delay, as brought out by Dr. Hume and Dr. Shearer. The other matter is the question brought up about a positive Wasserman reaction. In the past year, we have seen several cases in which treatment of cancerous lesion was delayed on account of a positive Wasserman. Often those lesions, even though they are cancer, will show response to arsphenamin, enough improvement to make the man handling the case continue anti-syphilitic treatment; which really may have been called for on the basis of the patient's general condition, but had no bearing on his mouth condition. As far as I can see the only hope of bettering our percentage in mouth cases, with any therapeutic method, is earlier recognition, and I don't know how we are going to bring it about, because these things are seen, in the first instance, by men who do not know cancer. They are seen by the general practitioner, by the dentist who doesn't do your type of work particularly, and, as a rule, these men don't recognize the lesions. After the patient has gone from one to another; has possibly seen half a dozen doctors, and two or three dentists, and has had silver nitrate applications and all the other things that are used, someone begins to think it is cancer. By the time the patient gets to some surgeon or a radiotherapist or somebody who is going to do something for him, probably the floor of the mouth is involved, probably he has a lymphatic involvement, and whatever chance he may have had earlier is gone. He is ruined by this delay, which probably is a result of perfectly sincere motives. Every man who has seen him would, if he had had any reasonable suspicion that the lesion was cancerous, probably have sent him to someone who could have handled the case.

Theodor Blum, New York City: A patient came to me with a history of numbness in the lower lip. The usual examination revealed nothing. The lip was immediately examined by roentgen ray but only after about five or or six weeks did we find some change in the molar region of that mandible. This persisted, and finally we were led to believe that there was a tumor developing in the jaw without any external evidence, as far as the condition of the bone itself was concerned. We sent this patient to the hospital for roentgen-ray and surgical treatment, which I consider the best at the present time. The jaw was dissected, after radium and roentgen-ray treatment, and it was found to be cancerous. The patient died shortly afterwards. On necropsy, it was discovered that he had a primary lesion, a primary carcinoma in the descending colon. Now we so often in our practice, see cases of numbness, and it is important for us to keep in mind the possibility of metastasis in the jaw or surrounding tissues. We also hear much about primary tumors of the jaw. Scudder has written a book on tumors of the jaw, based on his own experience, the experience of American surgeons and also of Heath of England and Perther of Germany, which I think you will enjoy tremendously. It was written, I believe, in 1912. As regards the adamantinoma, occasionally we find both the cystic variety and the solid variety in one, and when we do find that, we must not stop at simply removing the solid part of the tumor, but must remove all to prevent recurrence. Sarcoma is always malignant, in a greater or less degree, just as is carcinoma. All sarcomas are not of equal malignancy, but giant cell sarcomas, according to the most prominent pathologists or specialists interested in pathology of the mouth, are not malignant tumors, do not recur, do not form metastases

and show no glandular involvement, etc. I cannot endorse the statements of Dr. Sherrill that cysts are more prevalent in Germany than in this country. Cysts are more often diagnosed in that country by dentists interested in mouth surgery, and, therefore, are less often seen by the general surgeon. The differential diagnosis between cysts and cancers is often very important, although the roentgen-ray picture is very difficult to read in a good many instances. I recall a case of an epidermoid carcinoma of the mandible, in which the roentgen-ray diagnosis was practically impossible. It looked identically the same as any cyst, and the only indication of a cancerous growth was a small patch about 0.5 cm. in diameter on the ridge of the mandible. The primary carcinoma of the antrum is most frequently mistaken for either a cystic involvement of the maxilla or an abscess formation. But I think the typical softness of the growth, after it has broken through either the palatal or the buccal plate, and the roentgen-ray findings should put one on the right track. The criticism of Dr. Shearer regarding Dr. Sherrill's treatment of the sarcoma of the jaw is due to the fact that the two gentlemen do not speak the same language. I am quite sure that Dr. Sherrill is speaking of the sarcomas which develop either from the pericementum, called periosteal sarcomas, or from the bone marrow, called myelogenic sarcomas, as these are very malignant tumors and, to my mind, much more difficult to cure than carcinomas of the jaw. What Dr. Sherrill is speaking of is usually termed, in the average language of the dentist and the physician, epulis. Epulis is a misnomer. It designates nothing but the position of the tumor. It does not give any information as to its histologic makeup, and this is the type of tumor which arises usually from the pericemental membrane of the tooth, or the adjoining gingiva. These tumors we are all successful in treating by ordinary removal in toto. I believe that deep roentgen-ray therapy is less efficacious in sarcoma than in carcinoma. Dr. Quick's radium treatment is not radium treatment in itself. It is followed by surgery, and is therefore more successful. I agree with Dr. Infield that radium treatment followed by surgery, if indicated (it is not always indicated), is preferable to the uncertainty with which all operations of malignant conditions about the jaws are followed. We should avoid, if possible, all disfiguring and crippling operations. From my own experience, I believe we can get better results with radium and surgery than with surgery alone. We cannot expect the general medical and dental practitioner to recognize all the lesions about the mouth, because specialists know how difficult it is at times. But both professions must be trained to examine carefully and to note anything other than the normal in the mouth, sending the patient elsewhere if he cannot be taken care of there.

Horace M. Davis, Baltimore, Md.: My course of action at all times may be considered conservative. In listening to the argument presented here today, I ask myself the question, are all these cases under discussion malignant? I recall hearing a distinguished diagnostician and surgeon, in a discussion of this same question, say that, in many cases, he referred the patient to some capable diagnostician in whom he had confidence that his opinion might be verified. This is the open-minded and cautious procedure of the conscientious operator. The patient's rights and interests are paramount, and every effort should be exercised that he receive a proper service. If all who practice medicine and dentistry were competent men, and all competent men careful and judicious, we would see a much more uniformly successful result. The operation for malignancy is usually disfiguring, and in my opinion should be performed only in the face of most conclusive evidence. Recently, I operated on what appeared to be a radicular cyst. A section was made by the pathologist and an examination made, with a report of malignancy. Although the patient appeared to be rapidly recovering, she was at once subjected to the loss of the mandible. This may have been best, but I do not believe it, and feel that the operation should have been held in abeyance. Unnecessary damage by such operations cannot be undone, and in view of the fact that a campaign of more careful diagnosis has been started, let us hesitate to perform mutilating operations until it is absolutely determined that they are necessary.

Dr. Sherrill (closing): I am thankful to Dr. Blum for explaining the little difference in nomenclature between Dr. Shearer and me. I am in agreement with Dr. Shearer because I feel he was speaking of those growths, superficial, on the gum, which in

my classification I have included under epulis, nearly always benign. My experience is similar to Dr. Blum's in that deep roentgen-ray therapy is sometimes useful, but the deep therapy does not affect the sarcoma as much as it does the carcinoma. The trouble, in many instances, is that we want to handle these cases ourselves in our own way and not consult the periodontist, the orthodontist, the surgeon and the radiologist. The more information we can get about a given case, the better equipped we are to handle it; but we may come to an *impasse* because of a difference of opinion. No mutilating operation should be done unnecessarily. However, a mutilating operation will oftentimes save a life in cases in which radium and the roentgen ray would fail. It is in this type of case that the surgeon should cut and cut radically. The errors I have made are not in doing radical surgery, but in not being radical enough. I remember a sarcoma of the upper jaw in which I recommended the removal of the whole upper jaw. A rhinologist and a pathologist whom I consulted recommended enucleation of the antrum and insertion of radium within the antrum. This was done. There were several radium treatments, which did no good whatever. Removal of the jaw may have failed, but my belief has been from other similar cases, that, had I dissected the jaw, cauterized the base of the jaw with the actual cautery, and proceeded with radium treatment, better results would have obtained. I saw a case with Dr. Hume, seventeen years ago, in which, contrary to my better judgment, I was called on by the mother to take out a growth on a child's jaw. I excised the shell of the jaw, new bone developed and there was no disfiguration. Seventeen years later, the patient came back, the teeth loose, the jaw rarefied and carcinoma recurring. She had had seventeen years of comfort, but if I had performed a radical operation she would have been in better shape than she is now. In one case, a plaque was removed from the inside of the right upper lip. The skin was not involved, but the mucous membrane was and the lip was cut off under the skin. The patient was working in a factory, carrying a lot of coal dust around with him. He had a plaque about 1 inch broad on that portion on the right side of his lip. He made a recovery, but twelve years later, he developed an epithelioma involving the neck and the lobe of the left ear. I then removed the growth radically, taking out considerable skin around the part of the ear lobe, cauterized it thoroughly and had Dr. Young apply radium in several treatments. Several months were required for complete healing of the wound. This occurred two years ago, and the patient is still well. It is a question when a patient can be considered cured of cancer. It is indefinite. One may still be well at the end of three years, another not at the end of fifteen. The most important thing is to determine early what the trouble is, whether benign or malignant. If benign, you can stamp it out with the radium in some instances, with the roentgen ray in some, with the actual cautery in some, and in others with radical excision, but take the radical and not temporizing or partial measures for relief.

TRAUMATIC OCCLUSION AS A FACTOR IN PERIODONTIA: ITS DETECTION AND CORRECTION*

By M. M. House, D.D.S., F.A.C.D., Kansas City, Missouri

I APPRECIATE an invitation to present a paper before your society at this time, because we should have more collaboration and unified study of our problems in all of the branches and specialties of dentistry in order to broaden our minds and service for the benefit of the health and welfare of mankind. Too many in our profession study some special branch of dentistry to the exclusion of all others; which limits their knowledge to such a degree that a correct diagnosis in cases of an extensive nature is impossible.

Correct diagnosis is dependent on a thorough knowledge of many of the sciences plus an intensive study and years of experience in general practice. There are in reality few true specialties in dentistry; that is, in which the success of the work of the specialist is not dependent on work of other practitioners to a great degree.

In the practice of periodontia as a specialty, this is particularly true. Much effort is necessary to secure closer cooperation with the general practitioner, to the end that better prosthetic appliances may be designed and more attention given to the securing of proper occlusion.

Intensive study, long observation and practical tests prove conclusively to me that, as a profession, we are just beginning to realize that occlusion and normal function are the elements that control facial harmony and, in a large measure, the general physical development. A thorough knowledge of these facts is essential in all restorative and corrective dentistry.

In order to make a correct diagnosis we must *know* perfect form and function in the natural jaws and teeth, and how they develop. It is from this knowledge that we are able to determine what is the most nearly ideal occlusion in each case, because there can be no set rule. Occlusion, in effect, is a biologic factor, governed largely by typal conditions as accepted and taught in the arts and as classified and applied in dentistry by J. Leon Williams.[1]

TYPAL OR BASIC FORMS

There are three typal or basic forms; namely, square, tapering and ovoid, as illustrated by the square, triangle and circle. These, in pure type, are found but seldom; that is, when the form of the face, teeth arch and vault are all in harmony.

The alveolar structures, root and crown lengths, cusp depths and overbite of the anterior teeth are different in these types, but are truly distinctive in each. Therefore, an ideal condition

*Read before the Academy of Periodontology, Louisville, Ky., Sept. 18, 1925.

1. Williams, J. Leon: A New Classification of Human Tooth Forms, with Special Reference to a New System of Artificial Teeth, Dent. Cosmos, 56: 627, 1914.

for one type as regards esthetics, form, function and occlusion would be inharmonious for another. This is very simple in all of its phases when understood, and is fundamental to the esthetic, the operative, the restorative and all of the corrective branches of dentistry.

The Square Type.—The square type of face has nearly parallel sides and a straight or plane profile, and a strong development of the maxillae and mandible, with a prominent symphysis. The anterior teeth have straight proximal surfaces, with a slight convexity of the labial surfaces, thick necks, short crowns of heavy formation, and long, strong roots as compared with the crown lengths, which are well set in a heavy, thick alveolar process. The posterior teeth in character are the same as the anteriors, but have medium depth cusps.

The vault is low, broad, flat in appearance, and of more than the average in anteroposterior length. The arch form appears to have straight sides, with all of the teeth in correct alinement, and a slight anterior convexity from cuspid to cuspid. The maxillary teeth are nearly perpendicular to the occlusal plane, while the mandibular teeth are but slightly convergent lingually. The occlusion in this type is most nearly ideal, showing correct interdigitation and coordination of the cuspal relations. The basic curves and cusp depth harmonize with the slight degree of overbite. This permits equalized pressure of the whole occlusion in all ranges, and, of course, is the ideal according to our conception of occlusion.

The Tapering Type.—The tapering type face has tapering sides, as illustrated by the triangle with the apex downward. The profile is slightly tapering, and the mandible and maxillae are much lighter in structure, with a markedly thinner alveolar process than either the square or ovoid types, thus offering less resistance to stress and fracture. The roots of the anterior teeth and bicuspids are in close apposition to the cortical plate, and, owing to the thinness and formation of the osseous and soft tissues covering them, are perceptible both in form and alinement. The anterior teeth have tapering proximal surfaces, while the labial surfaces, especially of the maxillary central incisors, appear straight from the incisal to the gingival and flat mesiodistally. The maxillary cuspids and lateral incisors are more convex mesiodistally. The crowns of the anterior teeth are long, with narrow necks, and are thin and translucent. The roots are long and of lighter formation, but, in proportion to crown lengths, are shorter than those of the square type. The posterior teeth in character are the same as the anterior but have very deep occlusal bite forms.

The vault is high, appears narrow and is much shorter anterioposteriorly than the square type. The arch form has tapering sides, and the buccal axial alinement of the molars and bicuspids harmonize with the tapering lines of the face; while the axial alinement of the anterior teeth harmonize with the facial profile. The mesiodistal-axial alinement of the central incisors is perpendicular to the occlusal plane, and they are the most prominent of the anterior teeth.

The crowns of the maxillary lateral incisors are slightly inclined mesially, giving a tapering or braced effect to the vertical setting of the central incisors. They are slightly above the plane of occlusion.

The gingival thirds of the labial

surfaces of the maxillary cuspids are the most prominent, which gives them a slightly braced or tapering effect in their setting, harmonizing with the facial lines and giving a characteristic expression of strength, as well as stabilizing them to resist stress and shock.

The mandibular molars, bicuspids and cuspids converge slightly to the lingual, and there is an anterior inclination in the axial alinement of the incisors. This type has a long overbite and deep bite cusps, but the compensating curves of the occlusion do not permit equalization of pressure or balanced occlusion in the protrusive ranges.

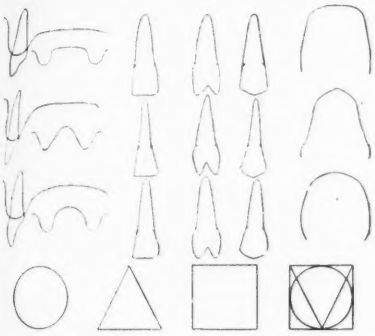


Fig. 1.—Square, tapering and ovoid types, showing various views of teeth, arch and vault form.

The Ovoid Type.—The ovoid type of face has curved sides and a slightly convex profile, especially the upper third, producing a regularity of form in curves. The mandible is well developed and has a strong, rounded alveolar process. The symphysis is somewhat less prominent than in the square type.

The crowns of the upper incisor teeth are broad, with curved proximal surfaces narrowing decidely at the necks, and the labial and buccal surfaces are convex, while the lingual surfaces of the maxillary central and lateral incisors are concave. The arch form is curved in harmony with the facial lines.

The roots are not so heavy and strong as those of the square type but are in better proportion to crown lengths and cusp depth and have greater resistance to stress in the alveolar process than the tapering type. The vault is of medium height, oval and of medium anteroposterior length.

The tooth alinement is regular, with perhaps a slight lapping of the lateral incisors over the distal surfaces of the central incisors. The cuspal interdigitation and coordination is ideal. The cusps are of medium depth and the overbite of the anterior teeth and occlusal curves are in harmony, which permits equalized pressure in all of the functional ranges of occlusion. (Fig. 1.)

MODIFICATIONS DUE TO COMBINATIONS OF TYPES

Modifications due to the combinations of these types predominate because of the mixing of the species; while asymmetric forms are the result of not only typal combinations, but also early impaired development and function. Habits such as mouth breathing, thumb sucking and "pillowing" are also common causes. The lack of symmetrical form and development brings about conditions that are uniformly difficult to rectify from the standpoint of occlusion in all branches of dentistry.

Comparatively few people arrive at adult life without having lost one or more teeth; which results in a further change in form and function of both the osseous and the muscular structures, and changes the relations of the teeth to their opposing members. If the roots in the alveolar process are sufficiently

firm, the teeth will wear and thus prevent periodontal disease.

Owing to the different forms of development, loss or wear of the teeth or inefficient restorative work, function is likewise different, and this must, of necessity, be recognized in order to plan the best form of treatment, whether an adjustment of the occlusion by the periodontist, orthodontist, prosthodontist or operative practitioner. Age and oral and general health conditions are factors of vital importance in all cases in determining the kind of treatment and also the time that may be required to accomplish the desired results.

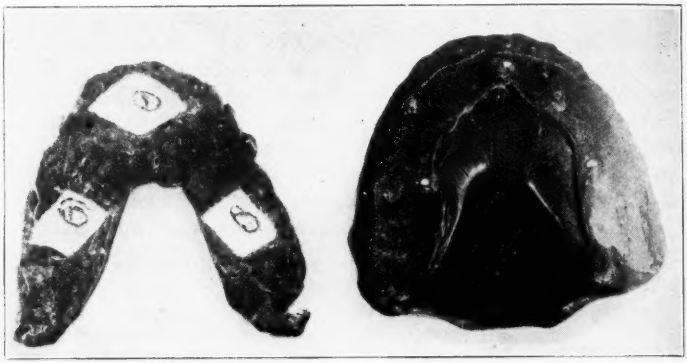


Fig. 2.—The 3 point tracings of the movement of the mandible in extreme ranges; also the circular forms of movement when the mandible is in slight protrusion.

EXPERIMENTAL DATA

In a series of tests, studies and observations of occlusion that are being conducted at the Deaner Institute, we are finding some interesting facts which apply to this discussion. The first problem was to determine how the teeth found their correct position in cuspal interdigitation and coordination. It was of special interest to observe that, after the teeth have come into contact with their opposing members, they have been gradually rotated and directed to correct position by function. In cases of retarded physical development in which either one or both of the jaws are undersized, while the teeth are of normal size, malalinement and abnormal occlusion must result. This condition results further in impaired function, incorrect breathing, inefficient mastication and various degrees of retarded physical development. Changes of arch alinement and rotation of teeth after the removal of orthodontia appliances result whenever the teeth have not been placed in harmony with the forces which are applied to them in function. Incorrect cuspal interdigitation and incoordination with the working paths result in occlusal trauma and account for the early tendency to pyorrhea in many cases.

The mandible is a lever of anatomic form, limited and controlled in its movements by the ligaments and muscles. Its form and the position of muscular attachments determine the lateral paths characteristic of each case.

The arch and tooth form, cusp form and depth influence the rotational positions of the teeth in the arch, and, in order to harmonize the occlusal relations of the teeth with function, these elements must be considered. This is of vital importance to occlusion, but it is given little consideration. In reality, its importance is not sufficiently appreciated by the profession generally, and this is the cause of many anatomic errors in restorative work. Tracings made of the mandibular movements show definitely the individual arcs of movement habitual to each in the various ranges of occlusion. (Fig. 2.)

The second observation in our study was that Nature has provided a horizontal freedom of movement in central occlusion. In order to determine whether such freedom was provided for in the occlusal forms of the teeth, or whether it came about only through the process of wear, the upper and lower first molars were removed from skulls in which the cusps of the teeth showed no effects of wear. When correctly occluded, they could be moved in the horizontal ranges a millimeter or more without interference with the incline planes of the cusps. The deeper cusp forms, with the more acute inclination of the cusp planes, have proportionately less horizontal freedom.

A large number of extracted teeth were next examined under a magnifying glass for the purpose of detecting the effect of wear. This proved to be of great interest because the worn surfaces were all arcs and curves. (Fig. 3.)

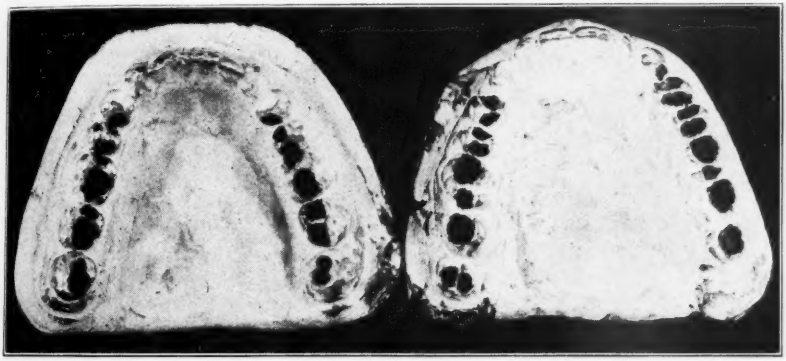


Fig. 3.—Case of natural dentition, showing mortar and pestle effects of wear in occlusal surfaces.

Casts were made from cases with a full complement of natural teeth with fine occlusion, with no restorative work to interfere with wear. The patients selected ranged in age from 16 to 65 years. A horizontal freedom of movement in the central or triturating ranges of occlusion was present in all cases to some degree.

Observations of the natural teeth and movements of the mandible showed an increase of the horizontal movement in direct ratio with the wear of the teeth.

Cases with end-to-end relations of the teeth, with worn occlusal surfaces, showed a much greater range in the ex-

cursions of movement and also in the direct lateral shift of the mandible. These longer excursions of movement effect a cutting as well as a crushing efficiency in mastication.

The cases with overbites and correct interdigitation of the cusp relations which were in the second stage of wear showed perfect mortar and pestle effects in the occlusal surfaces of the bicuspids and molars. (Fig. 4.) These cases showed the greatest horizontal freedom or third molars as compared with the incisors, and each case was different. I found, in my own case, that the opening and closing ratio of the incisors as compared with that of the third molars was 3:1; so for every 0.33 mm. of wear on the third molars, a full millimeter of wear would have been required on the incisors to have given freedom sufficient to prevent the forward thrust and separation of my maxillary incisors.

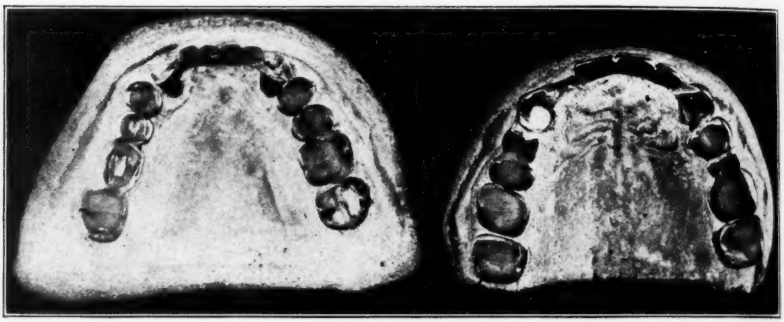


Fig. 4.—Case of bridgework with porcelain occlusal surface, showing arcs and curves of wear.

to be that of rotation, the pivotal point being in the bicuspid region. In direct relation to the overbite in the cuspid region, the mandibular bicuspids and first molars showed excessive wear of the buccal cusps; while the maxillary bicuspids and first molars showed excessive wear of the lingual cusps. This is due to the guiding effect of the overbite, especially of the cuspids, causing a vertical or an opening movement in excess of the lateral excursion. This was particularly noticeable in cases of broad development of the maxillae as compared with that of the mandible.

Measurements were made of the opening and closing ratio of the second

For every degree of wear and closing of the jaw relations, the mandible moves forward a variable amount, thereby changing the relations of the teeth to their opposing members. In cases in which the overbite is in excess of the cusp depths and the compensating curves of occlusion, there is excessive wear on the incisal and labial surfaces of the mandibular incisors, or there is a forward thrust and separation of the maxillary incisors.

In cases in which there is harmony of the overbite with the cusp depths and compensating curves, the closing relation of the jaws, owing to abrasion and the forward thrust of the mandible,

effects an end-to-end relation of the teeth with the opposing members. This, in turn, lengthens the excursions of movement, increases the rapidity of wear and shortens the teeth, closing the jaw relations perceptibly. In many cases, there was a lack of uniform wear due to the dentin's being in wearing contact with the enamel of the opposing teeth, which showed trauma and peridontal disease. We found no periodontal disease in cases in which there was uniform wear of the teeth in all of the functional ranges of occlusion.

Similar tests were applied to artificial dentures to determine whether we should obtain similar results. The first upper and lower molars of porcelain teeth, both shallow and deep bite-forms as they come from the manufacturers, were tested for horizontal freedom in central occlusion, as were the natural teeth taken from skulls. All of the porcelain teeth tested had definitely locked relations.

A large number of cases with full dentures were then tested, and, without exception, when cusps were present, the occlusions were locked, regardless of the machine grinding as done with articulators, and even when the occlusions were first ground and then chewed in by the patients with abrasive paste. The effects of these locked occlusions in full dentures are: irritation of the mucosa, progressive change of residual tissue, loosening of the dentures and inefficient mastication.

Another point of interest in the tests was the fact that by far the largest percentage of full dentures had cuspal interference in the lateral ranges of occlusion, and partial restorations, dependent on the mucosa for resistance to pressure, showed similar conditions.

The materials used in restorative work vary greatly in texture, hardness, wearing properties, etc., and in no way harmonize with the wearing properties of the natural teeth. This, in conjunction with incorrect occlusal forms and tooth anatomy, creates an ever-increasing amount of occlusal trauma, loosening of the teeth and periodontal disease.

Traumatic occlusion, or occlusal trauma, may be defined as an excessive thrust or pressure at one or more points in one or more of the ranges of occlusion. The detection of occlusal trauma is accomplished by a complete and systematic examination, and the recording of the condition of each tooth. (Stillman and McCall.[2])

Such an examination requires:

1. A complete set of radiograms of both jaws, showing the correct alinements, positions and lengths of the roots and crowns of the teeth, as well as the conditions existing in the alveolar process.
2. A faradic test of each tooth for vitality.
3. A digital test of each tooth for mobility.
4. Visual observation of the teeth in function and a notation of the conditions observed.
5. Chartings of all cavities, fillings, inlays, crowns, bridges, etc., and the condition of each recorded.
6. Study casts of all cases.

Spotting paste, painted on small areas at a time for the detection of points of interference, as a visual aid is very helpful. (F. A. Bricker.[3])

2. Stillman, P. R., and McCall, J. O.: Clinical Periodontia, Chap. 5.

3. Bricker, F. A.: Diagnosis and Treatment of Traumatic Occlusion, J.A.D.A., 11: 697 (Aug.) 1924.

In many cases showing excessive wear of the teeth and closed relation of the jaws, the correct placement of the mandible is without question a factor of great importance in the improvement of esthetics, mastication, deglutition, general health and, in some cases, the hearing. The recognition of these conditions is an important part of diagnosis, from which a correct method of treatment is made possible.

Proper procedure and the course of treatment for the correction of traumatic occlusion is wholly dependent on the conditions found by examination. The treatment may be classified as minor and major, the first being applicable to the corrective work of the peridontist, the second requiring his cooperation with other specialists or general practitioners. The peridontists are limited in their work in the correction of occlusion to the improvement of occlusal forms of fillings, crowns, bridges, etc., and the relief of interfering points on the incisal and occlusal surfaces of the teeth by grinding. Owing to the variation in the opening and closing ratio of the molars as compared with the incisors, a slight amount of relief on the posterior teeth causes excessive pressure and trauma on the anterior teeth.

I have seen many cases that were excessively ground, and in lectures we hear men advocate this treatment as it is practiced in full dentures; as it may be, in varying degrees, without harm. But this is not correctly comparable with natural dentitions, for the reason that any natural tooth that has been in function with its opposing member will extrude when relieved from function; so the ideal grinding treatment for the correction or prevention of trauma is the giving of slight relief or the changing of form without interfering with function.

The work of Gysi[4] deals with all of the arcs of movement, including the horizontal arcs in lateral ranges, as is shown in the tracings, which are different and habitual in each case.

The triturating or short ranges of movement from centric occlusion in mastication are circular in the plane of occlusion, as is shown in the mortar and pestle effects of wear on the occlusal surfaces of the natural bicuspids and molars. This gives the principle of Nature's scheme in the freedom of occlusion and the triturating or grinding efficiency in mastication which should be utilized in all of the restorative and corrective work of occlusion.

Following the adjustment of occlusion by spotting and relieving the interference with small engine stones, a paste of very fine grit having the properties of mild cutting and at the same time a polishing effect should be used to equalize pressure and correct the slight interference that may still exist in the functional ranges of occlusion.

In restorative work, the occlusion should be checked at regular intervals because of the variation in the wearing properties of the materials and that of the natural teeth.

CONCLUSION

It is essential to know what ideal occlusion and function are in order to appreciate their importance and to treat them intelligently in their many phases.

Occlusion of the teeth in all of its phases is of vital consideration to all branches of dentistry, as a health measure, and cannot be divided into special

4. Gysi, Alfred A.: Some Essentials to Masticating Efficiency in Artificial Dentures, Dent. Digest, November, 1920.

or limited zones for correction and treatment.

Traumatic occlusion may be the result of the presence of a mixture of typal forms or modifications in their many combinations, as well as developmental conditions, loss and wear of teeth, functional changes, etc. Volumes have been written on occlusion and its many phases, but a greater advancement and a clearer conception of its intricate details and their importance has come about through the organized and unified efforts of specialized and classified study in recent years. The importance and value of such organized study cannot be overestimated, and through cooperation, discussion and dissemination of the knowledge gained from our organized and specialized groups, great benefit will accrue to all, with a broadening of vision and improved service, for the betterment of health and the welfare of mankind.

DISCUSSION

F. H. Skinner, Chicago, Ill.: Collaboration and unified study of our problems in all branches of dentistry is absolutely necessary, if we are to make a success of periodontia, the harmonizing of all the specialties of dentistry. The periodontist who confines his work to scaling, polishing of teeth and adjusting of occlusion, by grinding, is extremely limited in his field and must be a big man in order not to become biased in his opinions. The prosthodontist, exodontist and orthodontist can specialize, but periodontia is the foundation of operative dentistry. I especially agree with Dr. House when he says "By true specialties, I desire to convey the idea of those branches in which the success of the work of the specialist is not dependent on work of other practitioners to a very great degree." The person practicing periodontia as a specialty can stop suppuration and the breaking down of process caused by infection from lack of cleanliness, but anyone having a degree of D.D.S., or D.M.D., who is conscientious in his work, and who has the proper instruments, should be able to do that. Unfortunately, they don't all do it. In the majority of our adult cases, the problem is, what to do after the mouth is cleaned up. Does the bite need opening? Should the mandible be advanced and how much? Should this all be done at once, or should the mandible be brought to proper position by steps? What kind of restoration should be used, etc.? Should tipping teeth be straightened up, in order to bring the stress of masticating force on the long axis? Ideal periodontia starts with a young, healthy mouth and keeps it so, but the most of us have to take cases as they are presented. Adjustment of occlusion and restorations are necessary, in order to stop excessive mobility of teeth, and this work must be done by the periodontist himself, or someone who understands what the periodontist is trying to accomplish and will work in harmony with him. In making a diagnosis of a case, it is necessary to have not only a knowledge of what normal occlusion should be in that individual case, but also a knowledge as to how to make restorations which will function correctly. In many cases, there is a tendency toward lack of mandibular development in the bicuspid and molar region, which can, to a degree, be corrected in childhood; and this is as much the work of a periodontist as restoring broken down mouths. Dr. House gives a clear definition of the three principal types with which we come in contact in the course of treatment, and which are fundamental factors in whatever restoration work is necessary. Even with these principles as a guide, it is frequently a problem for the man making the restoration to know just what is the best for that individual case. The studies carried on at Deaner Institute seem to point to the standardization of the spherical principles of occlusion. Dr. House says "for every degree of wear and closing of the jaw relations, the mandible moves forward a like amount, thereby changing the relations of the teeth to their opposing members." He also speaks of the wear on the lingual surfaces of the upper incisors and on the incisal and labial surfaces of the mandibular incisors. I should like to ask Dr. House if there is as much measurable forward movement of the mandible in the tapering and tapering ovoid types, as there is in the square type, and if the condyle thrust is as pronounced in the square type, or end to end bite, as in the tapering where wear becomes pronounced; also, is deafness as

common in the square type as in tapering and tapering ovoid types. These conditions seem to warrant the restoration of lost tooth structure by building up the low places to arc with the highest point rather than grinding off high places to arc with the lowest point, which would mean opening of the bite, because the farther this wear is allowed to go, the more rapidly the teeth appear to wear away; hence, increasing pathologic processes. Dr. House also makes note of finding no alveolar disease in cases in which there has been uniform wear of the teeth in all of the functional ranges of occlusion. This would indicate that traumatic occlusion, or torque, as Dr. McDonaugh calls the cusp interference, plays a much more important rôle in our periodontoclasia cases than lack of cleanliness. Therefore, our restorations must be in absolute harmony with the type of case with which we are working. In full denture work, the finding of locked occlusion, regardless of grinding in, would indicate that the shorter the cusp, the more successful the work, or at least the more permanent, on account of less trauma to the supporting tissues. Obtaining correct harmonious cusp interdigitation between molar and bicuspid is an exacting mechanical procedure, applying to restorations made on natural teeth as well as in full denture work. Frequent readjustment of the occlusion of crowns or bridgework, especially if opposed by natural teeth, is necessary in order to maintain any degree of health in the mouth. Tooth will wear tooth, but tooth will not wear gold, neither will gold wear tooth. Unglazed porcelain will grind tooth substances or gold away. The idea of classifying cases which have full facial dimension, but cusp interference, which can be corrected by grinding, as minor cases; and those which need mandible adjustment, opening of the bite and restorations, as major, is a good one. Care and judgment must be used in grinding, for it is very easy to overdo or to grind in the wrong place. Cusp interference must be relieved, but interference only. Burnished spots in metal restorations and facets in the natural teeth are frequently guides as to where to grind. When excessive grinding of the lower incisors is necessary to balance occlusion, reconstruction work and opening of the bite to the proper vertical dimension seem advisable. All large cases of restorations, when possible, should be ground in on an articulator before being placed in the mouth, then placed in the mouth and checked and reground while in actual service. Few persons can reproduce their masticating movements while in the dental chair, so that frequent visits to have burnished spots watched for are essential for a few weeks after restoration work. Use of spotting paste and articulating or carbon paper is frequently of assistance, but the burnished spots on the work itself are the most accurate aid we have in grinding to adjust occlusion. Therefore, it is absolutely essential that a periodontist have a full knowledge of all branches of dentistry. The patient will fare better if one man does the work, or at least superintends it, which means practicing general dentistry with periodontia as the central point around which all other branches revolve.

Dr. House (closing): In respect to the closure of jaw relations, there is a variable amount of forward movement of the mandible, depending on the relative position of the opening axis and the degree to which the cusps interlock, or the closeness of the overbite of the anterior teeth. Naturally, the deeper cusp formations and cases with overbite, having a more definite interlocking of cusps, would show less rapidity of wear and forward movement of the mandible. I do not believe sufficient research has been done to determine definitely whether the square, tapering or ovoid types would be most affected from the standpoint of deafness. I would refer you to the work of George S. Monson[5] and W. H. Wright.[6] Quite a number of cases are reported in which the hearing has been much improved by the opening of the bite. I have had three cases which have been decidedly improved. I believe that when the mandible is placed in a correct position in cases of overclosure, improvement is due to the more normal action of the muscles, improved circulation and the better drainage of the eustachian tube.

5. Monson, G. S.: Impaired Function as a Result of Closed Bite, J.N.D.A., 8: 833 (Oct.) 1921. Case Histories, J.A.D.A., 11: 55 (Jan.) 1924.

6. Wright, W. H.: Deafness as Influenced by Malposition of the Jaws, J.N.D.A., 7: 979 (Dec.) 1920.

A REVIEW OF THE BUCKLEY-PRICE DEBATE*

By JOHN ALBERT MARSHALL, D.D.S., Ph.D., San Francisco, California

THE affirmative of the question: Resolved that Practically All Infected Pulpless Teeth Should be Removed, supported by Price, presented four premises:

1. The present very high death rate from degenerative diseases is due in part to unwise treatment and retention of infected pulpless teeth.

2. It is so difficult as to be practically impossible to sterilize infected cementum in the mouth.

3. Individuals are so very different in their susceptibility to and defense against destructive degenerative diseases as to require different consideration and treatment.

4. The new evidence from blood chemistry reveals that the toxic substances from infected teeth can and do destroy the body's normal defenses and these seriously disturb or destroy function.

In defense of his first statement, Price quotes Charles Mayo (*Lancet*, June 13, 1925), as follows: "In America there has recently been a tremendous increase in heart disease and in infections, and post-mortem examination seems to show that much of this is fundamentally due to the teeth." He presents, in Table I, comparative death rates for 1923 and 1924, segregated in accordance with cause of death. Price's own city, Cleveland, shows a higher percentage from heart disease in 1924 than in 1923. Minneapolis shows a lower percentage. The two results are not comparable and are therefore not conclusive. Price asks, "How much dental infection does it take to ruin a heart in an individual who is susceptible, or, if it [the heart, individual, or bacterium] has elective localization qualities, even in an animal without special susceptibility?" To answer this question, he presents an illustration of a rabbit heart, showing a vegetative growth. This heart lesion was produced "by injecting into the rabbit the practically clear washings of two crushed teeth that had been extracted from a man, 26 years of age, suffering with acute endocarditis." Were the pulps of these teeth vital or infected? How does he know they were infected? Perhaps the micro-organisms from the case of endocarditis were circulating freely in the blood stream and producing what appeared to be a dental infection. If that is the case, every individual suffering from endocarditis, it would seem, must have his teeth extracted. He cites another case in which cultures from the tooth (with vital pulp) of a boy suffering from acute endocarditis were inoculated into thirty rabbits. "Twenty-eight of the thirty rabbits, or

*Resolved, that Practically All Infected Teeth Should Be Removed, J. A. D. A., 12: 1468 (Dec.) 1925.

93 per cent, developed acute heart involvement, and thirty of the thirty, or 100 per cent, developed acute rheumatism." Price says the boy was doomed before he was born, for he had, by inheritance, a marked susceptibility for heart involvement, and he was born in an age and in a community that did not yet have sufficient new truth to protect him against his preventable but impending doom. If that is the case, why blame the teeth?

Just what do these experiments show? As they are described, they are valueless. Too much is left to the imagination and there is little scientific description. Price quotes from his own researches in the effort to prove that infected teeth cannot be sterilized and admits that he has no knowledge of any method which would bring about this result. To prove the impossibility of sterilizing infected cementum, he places sterile absorbent points in a canal of a tooth having a fistula, and marvelous to relate the points are infected when left either five, twenty-four or forty-eight hours. This is tantamount to saying that a sterile dressing placed over a fistula eventually becomes infected. Let it be recalled that Lister died only a few years ago, but some time prior to his death, he demonstrated this point conclusively.

Price assumes that a single rooted tooth contains approximately "3 miles of closed canals." Let us be generous and say it contains 4 miles. Does it differ from any other infected area in the body in miles per gallon of antiseptic? It is quite apparent that infected dentin, after being treated with solutions of formaldehyd, still remains infected. Formaldehyd possesses, unfortunately, other properties besides bactericidal ones. Among others may be mentioned its power to coagulate tissues. That portion of infected dentin, the organic contents of the tubules, nearest the formaldehyd is efficiently coagulated in a very short space of time, as well as sterilized. The more remote portion probably is not. It is not sterilized on account of the fact that the coagulation of protein at its point of contact with the formaldehyd prevents diffusion of the antiseptic. The same remarks might apply to some of the solutions of formaldehyd which have been employed in root canals, but the results which Price has obtained are not in accordance with those of other investigators.

As proof that cementum remains infected, the extracted tooth "was planted beneath the skin of a rabbit under surgical conditions." This does not constitute a proof. In the first place, we wish to ask Price to define a normal rabbit. In the second place, we wish him to prove absolutely that this abscess did not develop from some other condition. In the third place, we wish him to prove that the tooth contained organisms before it was implanted and that these organisms were subsequently isolated in pure culture. In the fourth place, let him show that these organisms were recovered from the abscess said to develop and then grown in pure culture.

Apparently, new points have been discovered in dental embryology with which I am unfamiliar, as is noted by the following quotation from Price. "We can visualize the structure of the dentinocemental boundary by thinking of the details involved in the formation of a tooth. The two formative organs, building toward each other, throw

down at first a common continuous wall, which is in effect like a bottle or flask, the opening to which is at the root apex." I cannot picture these two formative organs growing toward each other, unless they possess the inherent property of looping the loop and jumping over the formed material already laid down. Dentin and cementum build away from each other, the dentin being laid down previously. Price stresses the "impervious nature of this common boundary" between dentin and cementum. He states that when the interior of a tooth is stained with silver nitrate, this stain does not go through the boundary and penetrate the cementum. Similarly, when cementum is stained, this stain does not go through the dentinocemental junction and stain the inner dentin. This is an admission that is damaging to his argument. And where does it lead us? An infected tooth becomes infected from one of two sources: the bacteria in the pulp or in the peridental membrane. But when the pulp is involved and dies, the bacterial toxins as well as the bacteria themselves, gain entrance to that portion of the tubules adjacent to the canal. They cannot pass through the dentin to the cementum on account of this barrier at the dentinocemental junction of which Price speaks. If bacteria or their products possess the property of passing into the tubules, that property must be one of diffusion and not of actual biologic movement. Antiseptics, fortunately, for the public at least, also possess the power of diffusion, and therefore no barrier is imposed between bacterial toxins and various antiseptics. Such being the case, the sterility of dentin may be readily demonstrated clinically as well as experimentally. Let us disabuse our minds of the bugbear of infected cementum and realize that the problems involved are more those of removal of the cause. When these conditions can be treated in the beginning there is ample clinical and experimental evidence pointing to the fact that these teeth are not a menace to the body as a whole. It has been emphasized many times that the experiments on the efficacy of root canal filling materials reported by Price were neither well designed nor properly executed, and that therefore any conclusions which he draws from these experiments are not to be considered.

Fortunately, the body does not depend on autoclaving to rid itself of bacteria. Whatever antiseptic may be used as a therapeutic agent, its function is merely to aid the white blood cells in combating infection. Test tube experiments relating to the peculiarities of "bacterial accommodation" are interesting from comparative standpoints of different antiseptics, but have only a limited application in surgical procedure. They do not show the chemotactic or phagocytic power characteristic of living leukocytes. In this connection, it might be well to point out that the classification of streptococci used by Price is not generally recognized today. It has been superceded by a more modern one.

Fortunately, Price recognizes the fact that "individuals are so very different in their susceptibility to, and defense against, destructive degenerative diseases, as to require different consideration and treatment." This is the justification for the extraction of unsuccessfully treated pulpless teeth and is equally the

justification for root canal therapy. It is just as preposterous to say that all pulpless teeth can be successfully treated as it is to extract them all. The points which Price advances in his argument on this matter are plainly not germane to the subject.

The chart entitled "Life and Illness Expectancy of the Three Susceptibility Groups" is inadequate, in that it does not show the relative percentages of these three groups to each other. A comparison of the vital statistics as prepared by the life insurance companies would throw an interesting light on the problem. For example, patients in the "inherent susceptibility" cases, who die between the ages of 20 and 30 constitute a very small proportion of the number; the "absent susceptibility" cases constitute a much greater proportion. From the data so far presented by Price on blood chemistry, either in his book on focal infection or in the articles which he has written, one is forced to the conclusion that his statements lack sufficient scientific foundation. It is well to remember, in discussing immunity and susceptibility to disease, that it is not so important to know "what kind of disease the patient has, as it is to know what kind of patient has the disease." The susceptibility of the host rather than the localization of the invading organism is the determining factor.

Buckley, in presenting the negative side of this debate, pointed out some of the fallacies in Price's arguments. He took time to speak to the issue and the quotations from his authorities are directly applicable to the point in question. Buckley mentions the statement of C. D. Lucas concerning "pathologic osteogenesis;" another development (?) in histopathology, which Lucas may elucidate.

Price's rebuttal is entirely foreign to the subject. He does not answer any of the questions propounded by Buckley and continues his pseudoscientific discussion of "blood calcium." Price's closing arguments refute statistics of the life insurance companies. The span of life today is much longer than ever before in the history of the world. He would have us believe that the increase in heart disease is due to infected teeth. Therefore, we are constrained to observe how extremely fortunate this is for the dentist, and how very unfortunate it is for the physician that there are no other avenues of infection into the body. His statements reiterating that tooth structure cannot be sterilized and that root canal fillings do not fill canals form a fallacious premise.

DIAGNOSIS AND THERAPY OF VINCENT'S INFECTION

By MEYER GOLOB, M.D., New York City

WERE it possible for the lay patient to write as learnedly of his illness as the physician, I doubt not that the report of his case would have a psychologic flavor and be injected with an element of human interest that the physician can hardly be expected to impart. Hence, it seems that the opportunity to present a case, interesting in itself, from the combined point of view of physician and patient, should not be neglected.

Report of Case

History.—There was, in my case, a singular absence of dental or oral sepsis, and the general condition of the mouth was good. The onset was quite sudden. I arose one morning with a feeling of extreme fulness in the mouth and ptyalism. Examination revealed a swelling of the soft tissue in the buccal cavity and intensely injected gums, which bled profusely on the slightest irritation.

The dentist, on whom I called without delay, prescribed a treatment of gentle massage and mild antisepsis. He had discovered that I had been an habitual user of chloramine-T as a mouth wash and ascribed my condition to the irritation induced by this antiseptic. His treatment only aggravated the symptoms.

The most annoying and distressing of my symptoms was salivation. Occasionally, I could feel the pouring of the saliva into the oral cavity as though it were coming from an open faucet. There was, at this stage, a noticeable swelling of the submaxillary and parotid glands. The marked foulness of the breath was highly embarrassing; and I was beset with sleeplessness. Topping all other symptoms, there persisted a mental depression that I felt to be out of all proportion to the degree of the pathologic process involved. However, I continued to work every day, in both clinic and private practice.

Diagnosis.—With the striking picture of disease that my condition presented, I applied successively to physician and dentist for relief. Their examinations developed a discouraging diversity of diagnosis, to-wit: syphilis, diabetes, pyorrhea alveolaris, aphthous stomatitis. The medical men were bent on tracing the etiology to a systemic condition, and the dentists, quite naturally, confined their search to local causes. Here, indeed, was a singular manifestation of medical sophistication, our agile mental processes leaping over the simple truth, which literally stared at us, because it was too obvious. Ultimately, a bacteriologist established the presence of Vincent's bacillus lodged between the gingivae, the fusiform in symbiosis with the spirillum.

Treatment.—The diagnosis certain, the question now, I thought, was merely one of treatment. This proved to be very perplexing. Neither the medical men nor the dentists to whom I applied knew just what to do, and, as a result, the treatment to which I was subjected was turned into a veritable orgy of speculation and experiment, at times of a quite lively nature and exceedingly painful. The administration of arsephenamin both topically and intravenously was freely suggested and as freely applied. Whereupon my condition reached the acme of intensity. The salivation became unbearable, actually necessitating the use of towels in place of handkerchiefs.

At this stage, at the suggestion of a dentist, I submitted to heroic amputation of the gums and to bathing with tincture of iodin. The effect of these new measures was soon evidenced by the loosening of the teeth involved to such a degree that their extraction became imminent.

Thoroughly discouraged, I resorted, for want of a better remedy, to irrigation of the oral cavity with boiled water, which had been cooled to the temperature of tolerance, combining this lavage with gentle massage of the gums. The procedure was in line with asepsis and antisepsis. The hot irrigations proved quite soothing and the gross symptomatologic condition subsided. But the threat of recurrence in all its severity was not removed. The teeth were still shaky, the upper incisors begging for extraction. The salivation was still excessive. There was a marked glandular enlargement, with cardinal symptoms of inflammation of the gingivae. The gums had an angry appearance, were tender to touch and bled readily.

Bacteriology: The spirochete and fusiform bacillus of Vincent were numerous in the smears, together with the ordinary mouth flora characteristic of oral sepsis.

Treatment: 1. Function of the teeth was restored by balancing the occlusion through grinding the occlusal surfaces to a state of functional coordination.

2. The teeth were made clean by the use of instruments and were maintained in that state by the aid of a toothbrush.

Treatment was based on the principle of physiotherapy: viz., the etiologic factors were suppressed and the physiologic tendencies encouraged.

Fig. 1.—Appearance of mouth immediately after first treatment.

At this point, I took a step that proved very fortunate. I placed myself in the hands of a dentist who, I found, had written with authority on this very disease. Notwithstanding the severity of my condition, a cure was effected in about three weeks. The photographs reproduced here show clearly the condition of the mouth before and after treatment, and, incidentally, offer excellent testimony as to the efficacy of proficient and scientific dentistry.

Summary—I quote verbatim from his summary of my case.

Pathology: This was a case of periodontal disease characterized by gingival hypertrophy, pus exudate, and more or less symmetrical destruction of the alveolar process. The teeth were all loose, but no one tooth had deep pockets. Blood vessel congestion in the gingivae was extreme, and bleeding was frequent and, at times, spontaneous.

This, I might add, was accomplished by (1) gentle massage of the gums; (2) paling and blushing of the gingivae by means of a toothbrush dipped in physiologic sodium chlorid solution, the inflammatory débris being removed thereby; (3) frequent flushing of the oral cavity with sodium perborate solution.

COMMENT

My case tends to show that Dr. Stillman was right in saying that "intense as is the virulence of the acute attack, cases of Vincent's infection show a surprisingly rapid recovery when correct dental treatment is instituted." According to Dr. Stillman, the disease is not self-limiting and must be combated vigorously. The objective of the attack on these micro-organisms should

be to "break up house" for them; which is readily accomplished by bringing air into their abode, thereby rendering it untenable. Hence, the use of sodium perborate, the efficiency of which lies in its power to liberate oxygen, for the Vincent organisms are anerobic in character. I found its mildly alkaline reaction preferable to the irritating hydrogen peroxid, however much diluted. Freedom from irritation is emphasized by Stillman. Astringents and escharotics such as iodin are therefore contraindicated, and the amputation of the gums is wholly unjustifiable.

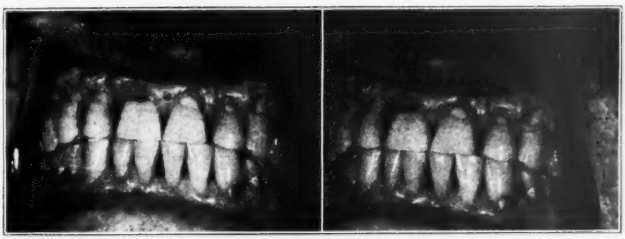


Fig. 2.—Appearance of mouth several weeks after treatment.

It is my impression that the average dentist pays but little, if any, attention to the bacterial flora of the oral cavity, or more cases of Vincent's infection would be detected. Because of this, I am naturally led to urge the adoption of a routine search for bacteria in all pertinent cases. The propriety of such a procedure becomes more apparent when it is borne in mind that the presence of this type of micro-organism is not inconsistent with the total absence of any cardinal symptomatology. Thus particularly as an instrument of oral prophylaxis—and this is the field with which dentistry is professedly most concerned—would such a routine examination be effective; for, by this means, those cases would come to light wherein the organisms lie in a slumbering state, awaiting the stimulus that will arouse them into activity. It is, in short, the substitution of preventive dentistry for curative dentistry.

That a large number of Vincent's bacilli and spirilla exist in the oral cavity may be seen from a table of smears taken by Hirshfeld[1] from seventy-five mouths chosen at random from such of his patients as had no clinical manifestation of Vincent's infection. This table showed the following: no Vincent bacilli and spirilla present, 24 cases; spirilla only, 12; bacilli only, 1; moderate number of bacilli and spirilla, 32; large number of bacilli and spirilla, 6; total, 75.

According to Hirshfeld, the presence of a large number of Vincent's bacilli and spirilla does not, of itself, denote an acute disease, but indicates the likelihood of a mild or chronic infection.

In my own practice, I have, on occasion, found it necessary to take issue with dentists who examined my patients and reported the absence of oral sepsis on the strength of negative roentgenographic findings in examination of the

1. Hirschfeld, Isidor: Vincent's Infection of the Mouth, New York M.J., 118: 150 (Aug. 1) 1923.

teeth. The Coolidge roentgen-ray tube is not equipped with a microscope! Yet such, it seems to me, is in effect the assumption a dentist makes, when, in basing his diagnosis upon a study of a roentgenographic silhouette, he is led to predicate negative cellular pathologic findings upon the basis of a total absence of lesions.

In a study of cultures made from the periapical tissues of 1,307 vital and pulpless teeth, as compared with roentgenographic findings, Dr. Haden,[2] of Kansas City, has shown that of 392 vital teeth, 9 per cent revealed from one to ten colonies in a deep agar tube; 5 per cent, ten or more colonies; and 1 per cent, more than 100 colonies. Of 490 pulpless teeth, negative in the roentgenogram—a point I wish to stress most emphatically—it was shown that 10 per cent had from one to ten colonies; 44 per cent, ten or more colonies and 24 per cent more than 100 colonies. Of 425 pulpless teeth with positive roentgenograms, 10 per cent revealed from one to ten colonies; 60 per cent, ten or more colonies; and 44 per cent, more than 100 colonies.

It is of vital interest to note Dr. Haden's conclusion that the incidence of infection is almost as high in the roentgen-ray negative group as in the positive group. "The absence of radiographic evidence of infection at the apex of a pulpless tooth does not infer the absence of an acute infection." In other words, the absence of proof from a roentgen-ray standpoint is no proof of absence from a culture standpoint.

2. Haden, R. L.: The Radiographic Diagnosis of Periapical Dental Infection in the Light of Bacteriologic Findings, J. Radiol. (April) 1925.

CONCLUSION

It may not be amiss to refer to the popular appellation of "trench disease" to Vincent's infection, bestowed in the belief that it is a visitation peculiarly liable to befall the soldier in the trench. There does not appear to be any basis in fact for this belief, but the term is aptly descriptive and, I think, may fittingly be used to imply the entrenchment of the Vincent micro-organism in the oral cavity. In this connection, I recall that Dr. Hyatt,[3] director of the dental division of the Metropolitan Life Insurance Company, emphasized the fact that the border line of the gingivae is eight times as long as the crypts of the tonsils. It is conceded by all that diseased tonsils have an injurious effect on the vital systems, such as the cardio-vascular and the gastro-intestinal, the biliary apparatus, and in fact on the body economy at large. It is, therefore, reasonable to hold that disease of the gingivae brings about toxic absorption, perhaps in proportion to the area of tissue involved. That the gingivae harbor enormous colonies of micro-organisms has been affirmed by Dr. Hyatt, who states that 1 mg. of a scraping of gingival tissue, taken from a normal mouth, contained 5,000,000 bacilli, while 1 mg. of tooth scrapings from a dirty mouth contained from 500,000,000 to 800,000,000; and that while normal healthy gums in a clean mouth are practically impervious to bacterial invasion, in the unclean mouth inflamed gums are open gateways for infection. This suggests the observation that we cannot keep a clean house without keeping a clean vestibule.

38 West Seventy-Sixth Street.

3. Hyatt, T. P.: Mouth Hygiene and Its Relation to Health.

THE END ORGAN OF THE EPITHELIAL SHEATH*

By RICHARD LANDSBERGER, Berlin, Germany

(Translated by Isaac Schour, B.S., D.D.S., Chicago, Ill.)

AFTER the formation of the enamel organ and the papilla, about the twentieth week, the tooth follicle develops, completely separating both structures from their surroundings and eventually enveloping them. A united and uniform organ is thus formed. This little sac, as is well known, consists of two layers, the inner and the outer. The outer layer by means of its fibers interweaves with the connective tissue of the surrounding area; while the inner one lies smoothly against the young tooth structure and later becomes one with the epithelial sheath and the young dental papillae. At first, as long as it is concerned only with the enamel organ, the follicle is rounded, and it surrounds the tooth germ like a connective tissue or bone-wreath. As soon as the tooth germ begins to grow and elongate correspondingly, the follicle extends also, and becomes oval. The alveolus is formed by the addition of bone in the outer fibers of the follicle, and grows farther and rises toward the border of the jaw as more bone develops. At the sides, the follicle is free and only in loose contact with the follicles of both neighboring teeth so that it can develop unhampered by its environment. At its base, however, that is, rootward, it is from the very beginning attached to the connective tissue of the maxillary bone. In consequence, the follicle, during its growth rootward, assumes an increasingly constricted and tapering form. We thus see the first indication of root formation in the more and more tapering course of the follicle fibers.

Since the inner fibers of the follicle and the young dental papillae are grown together, we can also recognize that, during the growth and stretching of the follicle, a rootward pull is exerted on the tooth pulp so that the latter is drawn forth from the epithelial cover which surrounds it. This fact suggested the mistaken idea that the pulp is in a way active in the growth of the tooth germ. It was supposed that the pulp tissue developed independently, formed a proliferation and thus exerted a *vis a tergo*, that is, pressure on the base of the dental germ, so that the tooth was raised more and more out of its alveolus. This supposition is contradicted by the fact that a completely developed tooth will still elongate, as, for example, into the space of its antagonist.

The follicle, before it reaches the pulp tissue, passes the epithelial sheath, lies very close to it, and later grows with it. The ends of the epithelial sheath are directed at first more nearly parallel

*From Deutsch. Monatschr. f. Zahnheilk, August, 1924.

and downward, but as soon as the growth starts and the roots begin to develop, they turn farther inward, and, in their later phase of development, make an almost right-angle bend. This is caused by the follicle. We know that its fibers taper as the maxilla is approached, so that the end of the epithelial sheath, which lies along and follows the course of the fibers of the follicle, is naturally crowded inward.

The follicle influences the epithelial sheath in another way. The outer layer of the epithelial sheath follows the fibers of the follicle, while the inner layer is held in place firmly by the pulp tissue which, being a part of the tooth, is carried upward by the growing alveolus. The epithelial sheath is thus subject to two antagonistic forces. In consequence, a split or interspace is formed between the two layers of the epithelial sheath. This space is filled by a delicate tissue, which contains fine platelets, small scales, vesicles and rings, the latter of which may be considered as part of tubules and canaliculi. Very often this space assumes a triangular form. It reminds one readily of the enamel pulp, and therefore we wish to call this space the pulp of the epithelial sheath and the entire structure the end organ of the epithelial sheath. It is an interesting fact that odontoblasts are deposited above the end organ. In a lecture showing the formation of the floor of the pulp chamber in teeth with multiple roots, Weski speaks of the "sensitizing contact effect of the inner enamel epithelium on the pulp surface." He supposes that the enamel epithelium exerts a stimulating effect on its surroundings. It is quite possible that the stimulus to the formation of odontoblasts arises from the pull that is exerted on the surrounding tissue when, as shown above, during the growth of the tooth, two antagonistic forces act on the epithelial sheath. We may visualize this process in the following manner: As soon as bone begins to form about the outer fibrous layer of the follicle, the alveolus grows and carries the tooth germ more and more toward the border. At the same time, in consequence of the growth of the alveolus, the inner layer of the follicle, in which no bone is built, stretches forth and assumes a form that leads rootward and constricts in an increasing proportion. The epithelial sheath is thus crowded more and more inward and curls over in its free ends. At the border, toward the base, the root opening is thus closed by the curled end of the epithelial sheath, but in the middle a free opening still remains. This free opening, which is intended for the root canal, gradually constricts from the side by means of the deposition of dentin. Connective tissue fibers, which grow exuberantly from the base of the alveolus, find their way through this opening and serve to guide and support the nerves and blood vessels. Cross-sections of the apex would clarify the conditions.

In view of the findings enumerated above, how are we to picture the growth of the root? Two conceptions are to be considered. One arises from the supposition that the tooth is stationary and that its root elongates as a result of the newly formed odontoblastic layer stimulated by the end organ of the epithelial sheath. As the root elongates, it pushes the end organ of the epithelial sheath toward the apex. In this manner, the end organ of the epithelial sheath effects the development of new odontoblasts. According to the other conception, the end organ of the epithelial sheath is stationary and the tooth is mov-

able. We know that during the growth of the alveolus the tooth is carried to the ridge, and it must, therefore, move away from the stationary end organ of the epithelial sheath. In this manner, more room is made for the deposition of odontoblasts and the root can again elongate the height of the deposited odontoblasts.

There is, therefore, a certain reciprocal relationship between the alveolus and the growing tooth. To the same extent to which the developing alveolus carries the tooth germ upward, room is made for the deposition of odontoblasts and the development of the root. The converse relationship is true. To the same extent to which odontoblasts are deposited, the tooth grows and the alveolus develops.

Since we consider the end organ of the epithelial sheath as the causative agent of the entire development of the root, we may further assume that the absence of roots in teeth is conditioned by a deficient development of the epithelial sheath, that is, by some sort of degeneration of the end organ or by its complete absence. It may be that the pulp of the end organ has not developed or that no odontoblasts are deposited in the surrounding tissue.

What happens to that portion of the epithelial sheath which lies between the crown and the end organ and which increases in length with the growth of the tooth? The photomicrographs show that the connective tissue of the follicle grows into the cells and destroys the epithelial tissue. Studies concerning this question are not finished. It seems, however, that there occurs a transformation and blending of the tissue with the cells from which the cementum of the root develops.

The Journal of the American Dental Association

58 East Washington St., Chicago, Illinois.

OTTO U. KING, Business Manager, C. N. JOHNSON, Editor.

Published by the American Dental Association.

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matters should be sent to the Business Manager.

Subscription is included in the annual membership dues. To nonmembers living in the United States or it possessions, the price is $2.50 a year in advance; Canada, $3.00; Australia, $4.00; other countries, $3.25. All foreign subscriptions are to be paid in United States money.

Entered as second-class matter, March 22, 1915, at the post office at Huntington, Indiana, under the Act of August 24, 1912. Published Monthly.

Editorial

A CHANGE OF POLICY

There has been an apparent change in the last few years in the attitude of the daily press when reporting dental meetings in different parts of the country. In times past, no reporter seemed to think an account of such a meeting was complete without the introduction of a lot of caricature and buffoonery. In fact, the chief part of the report consisted of this sort of treatment. Such headings as "The Tooth Carpenters Are in Session," "The Knights of the Forceps Are with Us," "The Tooth Tinkers Are in Town," and other similar euphonious and nonintellectual references were common in former days when announcing the meeting of a dental society. A newspaper account was never complete without belittling references to our calling, and a constant interjection of the idea that our chief function was to pull teeth. The ubiquitous and effervescent cub reporter exhausted his vocabulary, gained largely at that time by his association with ward heelers and plug-uglies of the back alleys, in his attempt

to make his report of our meetings "readable" for the public. The whole effect was to minimize any possible dignity that might legitimately attach itself to the practice of dentistry, and to hold aloft and emphasize every ridiculous aspect that could be distorted into applying to our profession. The sane and conservative men in dentistry, the very leaders of dental thought, almost grew to dread the newspaper reports of our meetings; and usually when they appeared, they were made to hang their heads and to indulge in a private opinion as to the worthiness of the press.

But all of this is changed. The press of today may quite generally be relied on to give an acceptable and praiseworthy account of a dental meeting, and if a little raillery is occasionally indulged in, it is not a serious matter and seldom has any venom back of it. It is usually not meant to belittle the profession, and, for that matter, we must not expect to escape a reasonable amount of badinage. All callings receive it, and often it is good for them. We must not assume a "holier than thou" attitude in this matter any more than in others.

The press is to be highly commended for the character of the reports of the dental gatherings of the day. They are calculated, for the most part, to give an accurate and intelligent interpretation of the advances in dentistry that have a logical interest for the public, and be it said that the people are thereby receiving information which they would not otherwise obtain. The press is a great educational agency, and when it devotes its energies, as it is doing in this instance, to the furtherance of the welfare of the people through the dissemination of reliable information on matters affecting health and happiness, it is worthy of the utmost commendation. The dental profession takes the greatest pleasure in doffing its hat to the press of the country, and congratulates it on the manifest change in policy, which represents a real service to the community along constructive lines, replacing a mere catering to the more unworthy interest of a sensation-loving class of readers. We predict that the influence of the daily press will increase in direct ratio to its adherence to its present policy of publishing facts connected with health matters as brought

out in our professional meetings, and its avoidance of distorted and sensational reports which have for their object an appeal only to the baser instincts of a certain class of the community. After all, decency is respected even though the indecent may at times and in some quarters be blinked at. Let the press stand by its present avowed principles of accurate and dignified accounts of professional meetings, and it will command without measure the respect of all thinking men in the profession—yes, and all thinking men outside the profession.

THE ETHICS OF PROFESSIONAL JOURNALISM

Many otherwise intelligent men have a very vague idea of the ethics involved in the publication of papers in professional journals. To begin with, there seems to be a misconception as to the ownership of papers that are read before dental societies. The moment an essayist reads a paper before any association, that paper becomes the property of the association. He has no right to present it before any other society without first announcing that it has been read elsewhere, and that it belongs to the association first receiving it. If this association has an official organ which publishes its proceedings, that organ has prior right to the paper. No other journal should publish this paper before it appears in the official organ, and then full credit should be given to the official journal.

The practice of some essayists of reading the same paper before several societies is all wrong unless they specify the facts to each society before which it is read after the original presentation. It is conceivable that a paper might be so important and so timely that it could justifiably be presented in different sections of the country, but this should be done only under the conditions just indicated.

Some of our dental journals have a rule prohibiting the use of material that has already appeared in print, while other copy extensively from other publications. It goes without saying that no journal should copy an article from another without giving

credit, and happily this practice is not so prevalent as it was at one time; but we sometimes see lapses even yet.

One very reprehensible habit that some authors have is to submit the same article to several journals at the same time without an intimation to any of them that it has been submitted elsewhere. This is chicanery of the worst type, and it usually ends in the ostracism of the author from admission to any journal. Being honor bright is just as essential in dealing with professional journals as it is in any other walk of life.

SUPPRESSING NOSTRUMS

The government is doing a commendable piece of work in the suppression of nostrums. Under the direction of Mr. L. F. Kebler, in charge of Special Collaborative Investigations, at Washington, assisted by Drs. M. F. Finley, Bruce L. Taylor and Arthur B. Crane, a fraud order has been issued against a certain pyorrhea cure which had been advertised as follows: "Stop pyorrhea. Save your teeth before it is too late." "The new scientific discovery kills pyorrhea germs and heals gums quickly. Sore or bleeding gums and loose teeth, sure signs of dangerous pyorrhea, lead to loss of teeth, rheumatism, neuritis, etc. Send for free trial treatment. Write today. Thousands are sending. Stop pyorrhea Now. Delays are dangerous. Simply send name and address." It was also represented that it would kill "the dangerous pyorrhea germs," and that "results" were "guaranteed," with many other absurd claims such as that the preparation "heals bleeding and receding gums—tightens loosened teeth—relieves pain."

The public has too long been victimized by misleading and spurious claims made on behalf of all kinds of nostrums, and many unworthy individuals have lined their pockets at the expense of the unsuspecting without furnishing them with anything of the slightest value. In fact some of these advertised nostrums do actual harm, and it is high time that the public was protected against them.

The government is to be commended for its activities along these lines, and a word of appreciation is also due those members of the profession who are willing to assist the government.

THE GORGAS MEMORIAL

On another page will be found a brief article on the Gorgas Memorial by the president, Dr. Franklin H. Martin. It will be seen that medicine and dentistry are uniting with other agencies in raising a fund which will be devoted to the purpose of preventing disease and prolonging human life. This is in perfect line with the general tendency of the day which has for its motto, both in medicine and dentistry, "prevention in preference to cure."

It seems entirely appropriate that physicians and dentists should unite in an enterprise like this, because both are concerned in the laudable purpose of conserving the physical well-being of the people; and the nearer they get together, and the more they consult, the better it will be for the public. Dentists have always been found willing to support any praiseworthy undertaking which has for its object the betterment of the race, and we have no doubt that they will come to the aid of this movement as they have of others of similar nature.

OFFICERS OF THE SECTION ON PHYSICS, CHEMISTRY AND METALLURGY, SEVENTH INTERNATIONAL DENTAL CONGRESS, PHILADELPHIA, PA., AUGUST 23-27, 1926

DEPARTMENT OF DENTAL HEALTH EDUCATION

CLINICAL RESULTS FROM PERIODIC PROPHYLACTIC TREATMENTS*

By GILLETTE HAYDEN, D.D.S., Columbus, Ohio

THIRTY years ago, D. D. Smith, of Philadelphia, began his work on preventive treatment for mouth conditions, to which he gave the name "oral prophylaxis treatment." Since then, the dental profession has had ample time to prove the value of this treatment, and sufficient opportunity to have its effectiveness clinically demonstrated through the results obtained by the followers of Dr. Smith.

That there may be no misconception as to what the object and nature of the treatment are, it should be stated that the object is " . . . the freeing of the oral cavity of conditions of tooth decay . . . and the eradication of infection from the same, to conserve human health and prolong human life."[1]

"In general, the treatment consists of enforced, radical and frequent change of environment for all the teeth and all mouth conditions, and the maintenance of perfect sanitation for the oral cavity."[1] It embraces the thorough cleansing and polishing of the teeth, the stimulation of gingival circulation and the careful supervision of the mouth at regular intervals, together with the education of the patient in both general and oral hygiene. The clinical results of periodic prophylactic treatments are those accruing from the cleanliness of the mouth, the education of the patient and the frequent supervision of the condition of the mouth and the work of the patient.

Cleanliness, in our mode of civilized living, is a recognized necessity to the maintenance of human health. Cleanliness of the mouth, while but one of the several known factors influencing the health of the teeth and their investing tissues, is a factor of unquestionable importance and one which may be controlled by means already long in use. Oral prophylactic treatments, conscientiously carried out, have been successfully employed for many years as helpful measures in the control of disease in the mouth because of their effectiveness in producing and maintaining mouth sanitation and health.

Associated with that cleanliness of

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Sixty-Seventh Annual Session of the American Dental Association, Louisville, Ky., Sept. 23, 1925.

*The papers of Drs. Hayden and Hyatt, with those of Drs. Millberry and Fones, published in the April issue, made up a symposium read before the Section on Mouth Hygiene and Preventive Dentistry.

1. Smith, D. D.: Six Years' Work in Oral Prophylaxis, 1904.

the mouth and stimulation of the investing tissues of the teeth to greater health resulting from periodic, preventive treatment are the cleanliness and stimulation of these parts made possible by a more accurate, thorough and systematic daily personal care of the mouth by the patient than is usually effected under the self-taught methods of brushing the teeth which are still the rule. The operator is the teacher of the patient and, as such, must instruct him in an effective method of caring for the mouth, and supply him with the means for carrying out his daily preventive care in order that satisfactory results may be obtained; but on the patient rests the duty of putting these instructions into practice.

Education of the patient in general hygiene, with particular emphasis on oral hygiene, brings clinical results that are both pronounced and far-reaching. The general laws of right living apply to the mouth as well as to other parts of the body, and the lack of their application often defeats otherwise obtainable healthy, oral conditions. The relation of nutrition, fresh air, cleanliness, exercise, work, recreation and mental habits or stresses to the health of the mouth are apparent to the observer of dental health conditions, and are demonstrable to the individual patient through the clinical results following the adoption of an improved plan of living.

Instructions in oral hygiene, especially in the necessity for the use and exercise of the teeth and their investing tissues through the thorough mastication of coarse and cleansing foods, and in the necessity for cleanliness, helps the patient, through better understanding, to contribute his share toward the desired results; namely, useful, clean, comfortable, healthy oral tissues.

Not the least worth-while result of the education of patients under periodic, preventive treatments is their increased appreciation of the value and benefit of clean, sound teeth in a clean, healthy mouth, and their intolerance of conditions unfavorable either to oral cleanliness or to health. With this appreciation comes also an appreciation of good dentistry. It seems safe to say that no dentist who gives his patients oral prophylactic treatments can avoid informing them on matters pertaining to good dentistry. This teaching creates certain standards in the minds of older children and adults which result in their demand for better dentistry and their appreciation of it when it is received.

The results of regular and frequent supervision that is possible under a régime of oral prophylactic treatments, may be stated as twofold: One is the opportunity for the early recognition and correction of defects or undesirable conditions which may develop; the other is the opportunity afforded the dentist for observation of the individual as well as of the collective behavior of mouths under certain conditions, or under a given régimé that may effect the oral tissues either favorably or unfavorably.

In only a part of the cases under this periodic supervision are the general hygienic conditions approximately constant over long periods of time, and the variations from the usual that affect or fail to affect the mouth conditions, furnish many opportunities for fruitful observations.

Children and adults alike benefit from oral prophylactic treatments. The benefits in the mouths of children and youths seem more pronounced in the teeth, because, during these age periods,

caries of the teeth is more prevalent than is periodontal disease. The benefits to adult mouths are associated more particularly with the investing tissues of the teeth because, in adult life, periodontal disease, in some one of its several phases, occurs more frequently even than caries.

It is now a well-established belief that pronounced benefits to the body as a whole result from the control and prevention of diseases of the mouth. The lessening of caries of the teeth reduces the opportunity for focal infection, and also for tooth loss, which impairs the usefulness of the masticating apparatus. The prevention of periodontal disease decreases the occurrence of systemic infection due to oral sepsis. In the control of dental caries and periodontal disease, the results of the application of oral prophylactic treatments are so pronounced that, if evidence counts, no doubt can be held regarding their great value as an aid in the prevention of oral and systemic disease.

The quality of the results of these treatments varies, quite naturally, with the individual understanding and appreciation of the aims and objects of these preventive measures, and with the technical ability of both the operator and the patient in carrying out the processes through which success is achieved. Nevertheless the results of conscientious effort are practically uniform.

The clinical results of periodic, preventive treatments for the mouth may be summarized as follows:

A clean and sanitary condition of the mouth.

Improved health and vitality of the tissues of the mouth.

Increased mouth comfort.

Increased ability and desire to use the teeth more thoroughly.

Improved appearance of the teeth and gingivae.

Decrease of sensitiveness of the teeth and investing tissues.

Prevention of dental caries, in part or entirely.

Prevention of periodontal disease.

Prevention of systemic disease caused by oral sepsis.

Early discovery of any defects or undesirable conditions which may develop.

Better understanding by the patient of the value of a healthy mouth and its relation to general health.

Greater appreciation and demand by the patient for better dental service.

Opportunity for fruitful observation by the dentist.

Every safe measure that helps to accomplish these results is a necessary instrument in the hands of the profession in the solution of the problem of control and elimination of oral disease and oral sepsis.

In the words of William Hunter, M.D., "There can be no doubt that the future of oral pathology and treatment, and therefore of practical dentistry, depends upon the extent to which those who occupy themselves with these subjects are trained in the principles and impregnated with the fundamental truth of oral sepsis and oral antisepsis."[2]

There is now, happily, evidence on all sides that the interest of the profession in the prevention of diseases of the mouth and in the elimination of oral sepsis as a factor in systemic disease is focusing the attention of an ever-increasing number of dentists on the

2. Hunter, William: The Role of Sepsis and of Antisepsis in Medicine, Lancet, Jan. 14, 1911.

preventive measures that contribute to the maintenance of the health of the oral cavity. The oral prophylactic treatment has consequently grown in the esteem of the profession as dentists have come to realize the possibilities and the results of this means of prevention.

289 East State Street.

THE CONSERVATION OF NONCARIOUS FIRST PERMANENT MOLARS*

By THADDEUS P. HYATT, D.D.S., F.A.C.D., New York City

TO propose the building of a railway would imply there are reasons why such a road should be built. The proposition must be practical and contain facts so evident that the reasons for building such a road will be apparent to all.

Likewise the subject of this paper: The suggestion that we take under consideration the first permanent molars implies there are reasons why first permanent molars should be considered. The proposition is based on the following facts:

1. These molars are the largest of the masticating teeth and they perform the heaviest work in the mastication of foods.

2. They are present at a time when the deciduous molars are being lost, and during this period they are often the only masticating teeth in the mouth.

3. They are the keystone of the dental arch and their presence is necessary for the symmetrical development of the jaw and the proper location of the other teeth in the dental arch.

4. Their early loss impairs the masticating efficiency of the other teeth.

5. Their early loss brings about traumatic conditions injurious to the soft tissues of mouth.

6. Many of these teeth have occlusal surfaces formed so that they afford lodgment undisturbed, and adhesion, for the bacterial plaques.

7. The bacterial plaques are the active factors in dental caries.

These facts should prove the importance of our considering what can be done for the conservation of these teeth.

Let us now return to the illustration of the railway. Having decided to build, our first work is to survey the land and then make our plans according to the conditions found. Likewise, before suggesting any procedure for the treatment of noncarious first permanent molars, let us make a survey of the actual conditions as they exist today.

The accompanying tables are taken from an examination of 1,000 charts of industrial workers, male and female, 16-25 years of age, average, 19 years. These figures are a fair estimate of the actual conditions existing in any part of the country.

*Read before the Mouth Hygiene and Preventive Dentistry Section at the Sixty-Seventh Annual Session of the American Dental Association, Louisville, Ky., Sept. 23, 1925.

TABLE 1.—NONCARIOUS FIRST PERMANENT MOLARS

	Number	Per Cent
First Permanent Molars	393	9.7
Upper right 1st molars	104	10.4
Upper left 1st molars	125	12.5
Lower right 1st molars	67	6.7
Lower left 1st molars	97	9.7

Table 1 shows that 90 of every 100 first permanent molars have been damaged by caries. This should give us food for reflection. It is not only a national calamity, but also a condition which the dental profession must find a way to overcome.

If we add together the teeth lost and those badly decayed, we find that 29.7 per cent of all first permanent molars are practically destroyed. If we add to these figures the teeth that are crowned, this will make the total 33.5 per cent. After deducting the number lost, badly decayed and crowned, we find, of the 2,659 first permanent molars left, only 393 are noncarious; in other words, of the 4,000 first permanent molars that these young people started life with, more than 90 of every 100 have been damaged by dental caries.

TABLE 2.—FIRST PERMANENT MOLARS LOST, BADLY DECAYED OR CROWNED

	Upper Right	Upper Left	Lower Right	Lower Left	Total
Lost	171	220	353	383	1,127
Badly decayed	18	14	15	17	64
Crowned	47	25	42	36	150
Total	236	259	410	436	1,341

Badly decayed teeth are those with three sides broken down or with exposed or nonvital pulps. What the condition of the teeth was when they were crowned, we do not know.

Table 2 shows that more than 28 per cent of all first permanent molars are lost. Please realize that this loss is in a group whose average age is only 19. Try to visualize the fact that each of us has his share in the responsibility for this loss. Do not let us deceive or mislead ourselves by talking about nutrition and ductless glands when we know full well that any opening in the enamel, or any formation of the enamel which affords lodgment for and undisturbed retention of the bacterial places, is the first step in the development of dental caries. As long as these plaques are neglected by the rank and file of our profession; as long as they are ignored in our dental clinics, just so long will the appalling conditions regarding dental caries continue to exist.

We find a higher percentage of carious cavities in the lingual side of upper molars than in the lingual side of the lower molars. We also find a higher percentage of carious cavities in the buccal side of the lower molars than in the buccal side of the upper molars. In the lower molars, we have the buccal grooves and pits; while, in the upper molars, there is the distal occlusal groove extending over and on the lingual side of the tooth. This explains the reason for these figures.

As regards these compound cavities, it is not possible to state in which side the decay first started. The figures given in Table 3 show that it is not unreasonable to assume that the origin of decay was in the occlusal side of from 50 to 70 per cent of these compound cavities.

This survey established the following facts:

1. More than 28 per cent of all

first permanent molars are lost before the age of 25.

2. In the occlusal side of all first permanent molars, we find more than double the number of carious cavities that are found in all of the other four sides combined.

3. The mesial sides have a larger number of carious cavities than the distal side.

4. The lingual sides of the upper molars have a larger number of carious cavities than the lingual sides of the lower molars.

5. The buccal sides of the lower molars have a larger number of carious cavities than the buccal sides of the upper molars.

In addition to the facts presented in these tables, we know that from 17 to 20 per cent of all first permanent molars are lost among high school boys and girls, and that more than 47 per cent of these molars are lost among adults.

Does not this survey prove to us the necessity of our advocating some procedure different from that which has been followed in the past? When we realize the amount of malocclusion that follows the loss of these teeth; when we realize the damage done to the surrounding tissues because of trauma; when we realize the loss of food value through improper mastication, can we not understand and realize that some procedure must be evolved, approved, adopted and put into general practice for the treatment of these teeth before caries has attacked them?

There are several reasons why I believe in advocating operative procedure for fissures before decay starts, in preference to waiting and operating after caries has penetrated into the dentin:

1. The dentin is more susceptible to rapid destruction when the teeth are newly erupted than at any other period.

TABLE 3.—CARIOUS CAVITIES OR FILLINGS IN THE DIFFERENT SIDES OF FIRST PERMANENT MOLARS AFTER DEDUCTING THOSE REFERRED TO IN TABLES 1 AND 2.

	Upper Right		Upper Left		Lower Right		Lower Left		Total	
Table 1	104		125		67		97		393	
Table 2	236		259		410		436		1,347	
No. molars left	660		616		532		467		2,266	
No. carious cavities or fillings		Per Cent		Per Cent		Per Cent		Per Cent		Per Cent
	600	100	536	100	516	100	465	100	2,117	100
Buccal side	9	1.5	26	4.8	156	30.2	141	30.3	332	15.6
Lingual side	100	16.7	76	14.3	30	5.7	6	1.3	212	10.
Mesial side	55	9.2	31	5.7	31	6.2	18	3.9	135	6.4
Distal side	14	2.3	13	2.4	14	2.7	11	2.3	52	2.4
Occlusal side	422	70.3	390	72.8	285	55.2	289	62.2	1,386	65.6

TABLE 4.—COMPOUND CAVITIES

	Upper Right	Upper Left	Lower Right	Lower Left	Total
Buccal-occlusal	9	8	14	13	44
Lingual-occlusal	27	29	9	8	73
Mesial-occlusal	60	67	47	36	210
Distal-occlusal	16	18	32	19	85
Total	112	122	102	76	412

Dr. Bodecker, of Columbia University, informs me that, as we grow older, the tubules of the dentin become smaller and the dentin becomes denser. In children, the dentin is less dense because the tubules are larger. In the newly erupted tooth, the acid of decay causes greater and more rapid destruction of the dentin because of the larger tubules, and greatly facilitates the spread of decay.

2. From 80 to 85 per cent of the first permanent molars are imperfect before eruption, because they have fissures in the enamel.

3. After eruption, the bacterial plaques find undisturbed retention in these fissures, and the acid of decay finds easy access to the dentin.

4. While caries is spreading under the dentino-enamel junction, no visible evidence of it is shown until a considerable amount of destruction has taken place.

5. Even when there are no fissures, we may find grooves which are narrow and deep. These deep narrow grooves afford lodgment undisturbed, and attachment, for the bacterial plaques, and because of their shape, the bacterial plaques cannot be removed by ordinary brushing or mastication.

6. There is abundant evidence that even seemingly prompt action has revealed ravages of decay so extensive as to involve the pulp, and, often, more than one surface of the tooth was damaged.

7. Even slight penetration of caries into the dentin sets up pulp reaction.

8. There is abundant evidence that, in operative procedure, before decay had spread along the dentino-enamel junction, these small occlusal fillings have been permanent.

For these reasons, the following procedures for the prevention of caries in the first permanent molars are offered for your consideration.

PREVENTION OF CARIES

In the Occlusal Side.—As soon as the entire occlusal surface of the first permanent molar is exposed, clean at once with a fine pointed explorer and wash off with warm water. Clean again with hydrogen dioxid, and a pin pointed explorer, and wash off again. Keep the tooth dry with cotton rolls. The use of a retaining powder on the cotton rolls will enable one to be used on each side of the upper molar. Dry the surface and paint with a cavity varnish. Dry. Apply a second coat of varnish and dry again. Take a sharp pointed explorer and scratch through the varnish along the groove. Apply silver nitrate with an applicator and precipitate by the Howe method. Wash off, and, with a small engine brush and pumice, clean the whole surface. A fine black line will be seen where the nitrate of silver has penetrated into the tooth through the scratch in the varnish.

In this way, only that part of the tooth is treated which it is desired to treat.

As soon as the molar has sufficiently erupted, apply a rubber dam. The child, having become acquainted with the dentist because of past work, will now assist. Dry the tooth and examine with sharp explorers. If the explorer sticks anywhere along the line of coalescence, known as the developmental groove, operative procedure is indicated. If the operator has been fortunate enough to get the case before decay has started, there is absolutely no necessity for gold inlays. In fact, gold inlays are contraindicated. The only reason for a gold inlay in the occlusal side of a tooth is extensive decay. The less the decay, the less the reason for gold inlays. When no decay is seen, but, somewhere along the developmental groove, the explorer sticks, we know there is a fissure. Open this fissure with a new unused round bur, size ½. With short, quick, light strokes, it is surprising to find how soon we can cut half way through the enamel without causing any pain. Use the chip blower and warm air. We must constantly use the explorer to ascertain whether the fissure is still present. It is necessary to secure a smooth floor to the cavity, one in which there are no uneven depths or pit holes. Generally, it will be found that this will lead through the enamel to the dentin. Now, use a bur size 1. After opening the cavity, a slight tilting of the hand while cutting at the level of the floor of the cavity will give enough enlargement so that undercutting will not be necessary.

I prefer amalgam. Anyone who is sufficiently interested in this work to have carefully followed the technic already described will use the care and skill necessary to put in a good filling, whether it is amalgam or gold foil.

At a subsequent sitting, trim these amalgam fillings with a fine cut finishing bur and burnish with a tantalum point.

In a report made by Dr. Ottolengui, chairman of the research committee of the New York State Dental Society, on "The Failure of Amalgam as Commonly Used," it was stated that practically 100 per cent of the occlusal amalgam fillings which had been polished showed no signs of recurrent decay. In view of this, it can safely be said that when noncarious fissures are opened and filled and the fillings kept small, and these fillings are polished, there never will be any need to refill. In other words, you have practically a procedure that to all intents and purposes has made this surface immune to decay.

Where deep narrow grooves are found, clean with explorers and hydrogen dioxid. Treat with a varnish and silver nitrate, and clean off as already described. Dry and fill these grooves with silver cement, copper cement or copper amalgam, as seems best. No cutting is necessary in these cases. Polish and make smooth with fine cut finishing burs at a subsequent sitting. It is very important to make every occlusal surface free from any kind of formation which will afford attachment for bacterial plaques. Those surfaces of our teeth which are free from bacterial plaques are immune to dental caries, even in mouths in which caries has been rampant.

The operative work of the future will not be the removal of decay; it will be the care and preparation of the teeth so that there are no retention places for decay to start. The nearer we can approach this, the nearer we shall come to the ideal dentistry which will protect the teeth from decay.

In the Mesial Side.—I would advocate the removal of a badly decayed deciduous second molar which cannot be filled, as soon as the first permanent molar erupts. If the deciduous second molar is decayed, but the distal side is not involved and the tooth can be retained with proper attention, by all means treat and retain it until the proper time for its exfoliation. If the deciduous second molars are noncarious, decay is not likely to occur in the mesial side of the permanent molar. However, polish the mesial surface of the first permanent molar with the finest cuttle fish strips. Teach the mother how to use floss silk at this place, and advise her to bring the child to see you three or four times a year.

In the Buccal Side of Lower Molars.—Leaving out the occlusal carious cavities, we find that more than five-sixths of the carious cavities left are buccal. Prompt attention should therefore be given to the buccal grooves and pits. A careful examination with sharp pointed explorers should be made. If an entrance can be found anywhere, particularly in the pits, open at once and fill. If the explorer cannot enter, it is wise to dry, varnish and treat with silver nitrate, as described above.

In the Lingual Side of Upper Molars.—We will find that the distal occlusal groove extends over and up on the lingual side. It is called the distolingual groove. About half way up on the lingual side, a pit is often present. In the buccal side of the lower molars, the pit is generally found at the end of the groove or at that point nearest to the gingival; whereas, in the lingual side of the upper molars, the pit is usually half way up the groove and not at the extreme end. If an explorer cannot find an entrance, treat with silver nitrate as described in the treatment of the occlusal side. If the distolingual groove in the occlusal side has to be opened, be sure to extend the cavity preparation to the end of the groove in the lingual side.

ADVANTAGES OF CAVITY PREPARATION BEFORE CARIES DEVELOPS

The advantages of cavity preparation before caries develops are as follows:

1. Cavity preparation is simple and there is no need for undercuts.

2. All that is necessary is to have a flat bottom and smooth walls.

3. Slight enlarging of the width of the cavity at the bottom is all the undercutting that is needed.

When caries has once penetrated below the enamel in newly erupted first permanent molars, the acid of decay penetrates deeply into the dentin without any external evidence of its presence. Because of the greater rapidity of the action of the acid of decay in the dentin of newly erupted first permanent molars, no time should be lost in temporizing by watchful waiting, particularly when we find, with the aid of a sharp pointed explorer, that fissures are present. Our only means of clinically diagnosing the presence of fissures is the sticking of the sharp pointed explorer. It is unfortunately true that there may be microscopic fissures which our explorer cannot detect. I do not know how we can overcome this at the present time. This fact, however, should make it all the more important to operate at once when fissures are found. We should also realize that it is impossible for us to tell from surface examination, when fissures go through the entire thickness of the enamel and

when they do not. This can be ascertained only in operating.

If any hesitancy is felt about cutting into the grooves which have fissures at their base, but without apparent decay, the operator should remember that 99 of every 100 of these fissures will have to be filled some day. The decision must be made as to whether it is more scientific to wait until decay is present or to fill now and prevent decay from entering the tooth. When the sharp pointed explorer enters any groove and sticks, a fissure is present. When the groove is narrow and deep, and the explorer does not stick, this place must be protected with a prophylactic filling. This is done by thoroughly cleaning out the groove, drying and filling with copper cement or copper amalgam.

Dentistry of the future must prevent the entrance of decay into the tooth, if we are to have any success in the oral hygiene campaign and in the education of the people.

DISCUSSION

Celia Rich, Nashville, Tenn.: Dr. Millberry implies that the legal status of the dental hygienists, like that of other groups, is defined by law. But while broadly speaking this must necessarily be true, a review of his paper will itself convince us that in this particular group the duties have not been made sufficiently clear. That this is true is further evidenced by the fact that every paper or report, in any section whatsoever of the American Dental Association, which deals with the subject of the dental hygienist either discusses or gives rise to discussion of the duties which are or properly should be hers. This discussion is, of course, stimulated, if not produced, by the fact of the wide variance of graduation requirements in the different sections of the country. For example, Dr. Millberry has criticized the Minnesota law for permiting dental hygienists to administer anesthetics; but, while this may seem unwise to all of us, and even preposterous to those in the states which admit dental hygienists to practice after examination when they have had two years at high school and one year in a school for hygienists, we must note, in contrast with these requirements, that in the State of Minnesota, a candidate for license must have a graduate nurse's diploma and three months of special training as a hygienist. I have not been able to ascertain in the short time since this paper came into my hands what the qualifications are for a graduate nurse in Minnesota. It is possible that a course in administering anesthetics may be part of her training for this degree and hence a prerequisite for graduation as a dental hygienist. It is obviously of great importance here as in dentistry and medicine that cooperation between various states and interchange of license, etc., should maintain. But see how dangerous, really impossible, this is under existing conditions. Dr. Millberry's suggestion that the dental hygienists' association publish its deliberations in THE JOURNAL does not seem practical, inasmuch as THE JOURNAL is at the present time overcrowded with material, in fact behind in the publishing of much matter of great scientific interest to the profession. There has been a great deal of talk about the relation of dentist and hygienist, but it would seem that in many cases the most important point of all has been lost sight of; that is, the obligation of both to their patients and to the public, in this interrelation. The hygienist is too often not merely just a scrubber of teeth, but even worse, in many instances simply a money making accessory to the dental office. Of course this need not and should not be. The dental hygienist has come to fill a great need, a need emphasized if not created by the present great oral hygiene movement, and personally I have found her services almost indispensable in private practice. However, Dr. Fones is quite right in emphasizing her field of greatest usefulness as that of teacher, or better, propagandist for dental health. I should like to subscribe most heartily to his conviction that, in this, she must go farther than the mere polishing of tooth surfaces, or even instructions as to the local care of mouth and teeth. If the past decade has taught us anything in physiology as well as hygiene, it has brought out the close correlation of all parts of the human economy, and more particularly the importance of the entire alimentary canal and of what enters it by the mouth, as contributing factors to all health and, not less than the rest, to dental and oral health. The dental

hygienist must be trained to impart knowledge of these things. As Mr. Sutton so aptly said, when he selected speakers to go out in the schools and clubs to spread this gospel of dental and oral health, that he wanted men not only who knew their subject, but who could talk it as well. Mr. Sutton may also be cited just here as a wonderful example of what Dr. Fones said concerning the advantage of having the cooperation of the school superintendent. Dr. Fones failed to state, but I am sure it was an oversight, that the preschool and very young child can best be reached by the dental hygienist in her work with mothers' clubs and parent-teacher associations. Dr. Hyatt's charts and conclusions are of great interest, but it seems to me that in spite of his startling statistics as to the prevalence of occlusal cavities, he has overstressed his care of this surface as compared with other localities. His one precaution for the mesial surface of this "keystone of the dental arch" has been the polishing of this surface after removal of the second temporary molars, whose extraction he advises whenever caries has seriously involved the distal surface. We are all familiar with the unwelcome cavities in permanent molars obviously caused by contact with a carious temporary molar. But why not use the silver deposit here before caries has advanced? And what is going to happen to the position of the first molars in his cases when he has extracted the second temporary molar at, say, 7 years of age? Unfortunately, this must sometimes be done at this early age, but it is very unwise to stop your prophylactic measures here. The sixth year molar thus deprived of its arch support drifts into an abnormal position, and occlusion and endless harm result. In any discussion of the subject of preservation of the first permanent molar, can we overlook the fact that many of these teeth are lost through periodontal disease, produced, in a measure at least, by malocclusion? Fill the distal surfaces of second temporary molars with amalgam carefully polished wherever possible and contoured to maintain the correct width of the interproximal space; and when the temporary tooth must be sacrificed, insert a prop to maintain the space and hold the permanent molar in position until the bicuspid erupts. The most important time for prophylactic treatment of the occlusal surface of the first permanent molar is before it has erupted sufficiently to make occlusal contact with the tooth opposite. At this period, it is best to place some plastic filling material in these grooves, after the silver deposit treatment, even though they are not carious or even faulty. I wish to endorse Dr. Hyatt's suggestion to use very finely pointed and sharp explorers for examining and cleansing the grooves and fissures. He has said nothing about the prenatal and early postnatal care of mother and child. This cannot be overlooked to insure (1) proper material for building the temporary teeth and thus provide in advance for a wholesome healthy environment into which the permanent molars may enter on eruption, and (2) the better nourishment of these teeth themselves and their supporting structures during the developmental period.

Alfred C. Fones, Bridgeport, Conn.: If I told you a story here today, and could get an interpretation from each of you, there would not be any two exactly alike. It is so difficult to get something over to someone else as it appears to oneself. Therefore, I expect to meet differing opinions, and to find very few who have the same vision that I have in regard to the dental hygienist. What is the function of the hygienist? During the ten years of the educational and preventive dental service in Bridgeport, the hygienists were educating the grade children in dietetics. We hoped to carry this teaching into the high school and have it include prenatal and baby feeding. You could make a new city out of Louisville, Bridgeport or any place else, if the girls leaving your schools had an intelligent idea regarding correct diet for expectant mothers and for children. Such teaching is a true part of preventive dentistry service in the schools, and while it will produce fine teeth, it results in fine bodies as well. That is what I hoped to bring out in this paper. The service of the hygienist, while apparently confined to the teeth, effects the body as a whole. It is so difficult to make the city officials understand this—they believe it foolish to spend large sums of money just for teeth, and do not realize that the whole organism is being favorably influenced, and the dental hygienists, although concentrating in an operative way on the hygiene of the mouth, are in a true sense general health workers. When we see the differences of opinion in the dental profession as to what the function of the dental hygienist is, it is not to be expected that the laity can have a clear understanding

of the service that the well trained hygienist is capable of rendering.

Thaddeus P. Hyatt, New York City: The extraction of the second deciduous molar after the eruption of the first permanent molar I do not think will involve very great danger, but the reason I did not refer to that was because I wanted to keep strictly to the one subject: the saving of the first permanent molar.

FOOD AND NUTRITION*

By KATE DAUM†, Ph.D., Iowa City, Iowa

THE almost spectacular discovery of the vitamins in the field of nutrition has led to a wide interest in them, but one still meets the traditional attitude that each individual considers himself an authority in this field, not only in looking after his own food but also in offering advice and criticism to those who are feeding others. One still meets the old fallacies, such as the danger, of eating acid food, such as fruit, with milk; or of eating fish and ice cream at the same meal, and one still hears enthusiastic reports of benefits derived from dietary fads.

On the other hand, there is an intelligent interest in nutrition, and a desire to apply the findings of science, as far as possible. This is reflected to some extent in the advertisements of food products. The intelligent advertiser of today endeavors not only to sell his product but also to educate the consumer on the use of it. This widespread interest makes it essential that the professions which have to do particularly with the health of the individual know the fundamentals of nutrition and how to use food as a therapeutic and preventive agent. Such knowledge gives a rational basis for comparison of new theories and fads and for evaluating new experimental facts. In talking of nutrition, there are certain attitudes which one must be careful to avoid and which one finds it rather difficult to avoid in dealing with a subject that can be applied so personally. 1. One must not draw general conclusions as to the need, use or effect of any one food on the body from a personal reaction; for instance, condemn the use of eggs because one personally is unable to eat them without an anaphylactic reaction. 2. One must not draw conclusions from uncontrolled experiments. 3. One must not draw conclusions from general observations; for example, the assertion is made that the Japanese are of low stature because of a limited and monotonous diet, and another group point to the Japanese as a peculiarly vigorous race because of their vegetarian diet. Neither group has legitimate proof of its statements.

EARLY THEORIES REGARDING NUTRITION

The subject of food and nutrition has a most interesting historical background. For many centuries, views and practices in regard to food were colored by the doctrine of Hippocrates, who formulated the idea of some spe-

*The first of a series of articles on nutrition by Dr. Daum.

†Research dietition in the Department of Nutrition, University Hospitals, State University of Iowa.

cific universal nutrient substance, present in all foods and subtracted from them by the alimentary tract. This doctrine leads to no distinction as to the value of one food above another. The basic idea is expressed in the following sentence of Richerand, published in a textbook in 1813, "There is but one food, but there exist several forms of food."

As chemistry advanced, methods of chemical analyses were applied to the composition of the body, to food and to its use in the body. This led to what might be called the first period in the science of nutrition, in which advancement came largely through the application of chemical analyses to foodstuffs. The presence of carbon, hydrogen and oxygen was recognized in the body as well as in all food. Later, the differentiation between nitrogenous and nonnitrogenous foods was made, and the presence of three constituents: proteins, carbohydrates and fats, both in the body and in food, as well as the importance of nitrogen in animal nutrition, was recognized. In fact, certain investigators, such as Liebig (1803-1873), so stressed the necessity for protein, particularly in the form of meat, that we still hear the saying, "To make blood and muscle, one must eat meat."

Voit in Germany and Atwater in America are responsible for the analyses of ordinary food materials which made it possible to talk of food in terms of grams of protein, fat and carbohydrate, or in terms of calories. The work of Voit, Rubner and Atwater brought to attention the importance of the energy content of food. Careful studies were made of the energy needs of the body under different conditions, and the intake of food was adjusted to these demands and expressed in terms of calories. Chemical analyses led to the recognition of ash or mineral matter in all food substances, and efforts were made to determine the requirements of the body for these various substances. At the same time, a great many digestibility experiments showed how completely the body utilized food in a mixed diet. These experiments were, to be sure, made on either animals or human beings, but, for the most part, were of short duration and with many uncontrolled factors.

At first, the protein foods were grouped together as containing 16 per cent nitrogen, but with better technic and more precise methods of analyses, the makeup of the protein molecule was recognized. With the isolation and determination of the amino-acids in the protein molecule, it was recognized that these differences in content might explain the differences in their nutritive properties. This led to efforts to maintain animals on so-called purified rations. Although these efforts were failures, they are responsible for the second period in the science of nutrition, in which advancement has been made through the biologic testing of foods.

BIOLOGIC PHASE

In this method, carefully bred animals, under controlled conditions of living, are fed more or less purified rations during growth and reproduction. The animals most commonly used are white rats, guinea-pigs, puppies, monkeys, cats and the larger domestic animals, such as cows, swine and sheep. The white rat has proved particularly valuable because it is omnivorous; its intestinal tract is similar to that of the human being; it bears captivity well, and its life span is short

enough that the experiments can be carried through several generations. Through the biologic method, we have been able to explain the appearance and cure of certain diseases, such as beri-beri, scurvy and xerophthalmia among people on a limited diet. It has also been possible to evaluate proteins from different sources and to explain the adequacy or inadequacy of other foods, such as the wheat plant, the maize kernel and cereals in general.

Briefly, then, the results of these investigations show that the body is made up of about sixteen elements, some of which are found in certain combinations called protein, fat and carbohydrate. The other elements occur in simpler organic or inorganic combinations or in solution. Foods, which are defined as "any substance which, taken into the body, can build new tissue or repair old, and furnish heat and energy," are made up of similar elements combined in the same way into proteins, fats and carbohydrates and showing other elements in organic and inorganic combination. The body uses the protein of the food to build new tissue and repair old and gets its heat and energy primarily from the carbohydrates and fats. The inorganic elements, such as calcium, phosphorus, iron, magnesium, potassium, sodium and iodin, are used in various parts of the body, such as the bones, the secretions and the individual cells and also in maintaining the acid-base balance of the blood.

THE VITAMINS

There are also the group of substances called the vitamins. The discovery of these has been the big contribution of the biologic method of testing foodstuffs. Their chemical makeup is not known, nor how they act; but it is recognized that they are essential to the body and that their deficiency brings about serious pathologic conditions.

We do not eat many of our foods in the form of pure protein, pure fat or pure carbohydrate, and when we classify food as protein or carbohydrate, we do so on the basis of the constituent which is there in largest amount. It is essential in dealing with nutrition that one be familiar with foods as classified on this basis. It is not uncommon to have a patient use maple syrup when told that he cannot have sugar, or to use rye bread instead of white when the carbohydrate intake is limited. Foods that are classified as important sources of protein are: milk (3.3 per cent), meats, such as pork and veal (average 18 per cent), fish (15-18 per cent), eggs (11.9 per cent), cheese (average 27 per cent), dried peas (24.5 per cent) and beans (22.5 per cent). Other foods show varying amounts of protein, but, with the exception of bread, have little influence on the total protein intake because they are used in relatively small amounts. Bread (9.0 per cent), because it is commonly used three times a day, may furnish as much protein as two eggs. Meat, which is high in protein, contributes an appreciable amount of fat to the diet. We have a few sources of carbohydrates which are almost 100 per cent carbohydrate: for example, sugar, i.e., sucrose and starch. Cereals (71 per cent), certain vegetables, such as potatoes (14.7 per cent) and fruits are our principal carbohydrate-rich foods. We seldom think of milk as a carbohydrate food, and still it has more carbohydrate (5 per cent) in it than it does protein. We have a few sources of fats in pure form, such

as the oils, olive, corn and cotton seed; butter, which is 85 per cent fat, and fats of animal origin, such as lard, suet and tallow. Foods that contain a good proportion of fat are bacon (59 per cent), certain other cuts of pork, cream, cream cheese (33.7 per cent) and egg yolk.

Of the mineral elements essential to the body, calcium, iron and iodin are most frequently deficient. It is particularly necessary that one watch the intake of calcium during the growing period. The principal source of calcium is milk. From one quart a day, a child receives enough calcium to cover his requirement and to permit maximum storage. Vegetables yield enough calcium to make them important sources for the adult, but they cannot replace in the child's diet the calcium obtained from milk. With milk in the diet and a liberal amount of meat, with some cereals, especially the coarse cereals, the phosphorus requirement is easily covered. Iron, though required in very small amounts in the body, occurs in equally small amounts in foods with the exception of the egg yolk. The leafy vegetables, such as spinach, and some of the dried fruits, such as raisins, are also important sources. The other salts, such as sodium, potassium and magnesium, occur in liberal enough amounts in all of our foods, so that there is no cause for worry unless the diet is very restricted. Iodin occurs in such small quantities in foods, with the exception of sea foods, that, in certain inland and mountainous sections, man and the domestic animals show the effect of an iodin deficiency in a goitrous condition. This condition can be handled so easily by giving small amounts of iodin at various times during the year that one need not be dependent on food as a source.

Since we know little about the chemical makeup of the vitamins, the quantative measure of their use in the body or of their presence in food has not been determined. We do know that certain foods are important sources of the different vitamins. Vitamin A, the fat soluble vitamin, as the name indicates, is associated with fats, and when deficient in the diet of the laboratory animal, a poor rate of growth and development is the result. If a marked deficiency is maintained for some time, a serious eye condition, known as xerophthalmia, develops. Feeding vitamin A from any source, such as milk, butter, cheese, eggs, liver, fish oils, especially cod-liver-oil, green leaves of plants, yellow vegetables, germs of seeds and tomatoes, results in normal growth and clears up the eye condition. Reproduction and rearing of a normal litter by the white rat is not possible on a diet deficient in vitamin A. Vitamin B, the water soluble, or antineuritic vitamin, is also necessary for growth, and its definite lack produces a condition called beri-beri in man or polyneuritis in pigeons. Growth is resumed or the beri-beri cured when vitamin B is added to the diet. The sources of vitamin B are: vegetables, yeast, fruits, milk, eggs, whole grains, legumes, kidney, liver and the pancreas. When vitamin C, or the antiscorbutic vitamin, is deficient, scurvy develops. This condition is overcome by the addition of vitamin C from any of the following sources: citrous fruits, tomatoes, potatoes, cabbage, onions and turnips. Vitamin C is less widely distributed than the other vitamins and is somewhat less stable to heating, drying or ageing of food. Vitamin D has to do with

calcium deposition and when it is lacking, rickets may develop. Cod-liver-oil and egg yolks are the two important sources of this vitamin. In this connection, it is well to say that radiant energy is also a factor in calcium deposition.

OTHER ESSENTIAL DIETARY FACTORS

Bulky foods and water are essential in the diet, though intake of the latter is not dependent on food, since it is customary to take an appreciable amount of water as such. The bulk of the food, which is essential for normal peristalsis in the intestinal tract, comes from the cellulose of the vegetables and fruits in the diet. Probably never more than 2 per cent of this cellulose is utilized by the body. The vegetables that furnish it in large amounts are what might be called the 5 and 10 per cent; that is, vegetables that contain 5 or 10 per cent of carbohydrate and practically no fat or protein, the remainder being water and cellulose. The 5 per cent vegetables are: tomatoes, spinach, asparagus, cabbage, onions, lettuce, celery and cauliflower. The 10 per cent vegetables are: carrots, turnips, string beans, green peas, beets; the 10 per cent fruits: grapefruit, watermelon, strawberries and lemons.

This brief review of the field of nutrition is given with the idea that, as particular phases are studied in some detail, a perspective of the whole field can be maintained. An understanding of all factors in nutrition, as far as they have been investigated, is necessary in order to bring about an "optimal"[1] state of nutrition.

SUGGESTED BOOKS*

McCollum: The Newer Knowledge of Nutrition.

Mendel: Chemistry of Life.

Rose: Feeding the Family.

1. McCollum, E. V.: Newer Knowledge of Nutrition, p. 58.

*Any of these books can be borrowed from the Department of Dental Health Education.

MOUTH HEALTH WEEK IN MISSISSIPPI

By GLADYS EYRICH*, Jackson, Mississippi

THOSE who guided the new supervisor of mouth hygiene in making plans for Mississippi Mouth Health Week, Oct. 26-31, 1926, have demonstrated a continuation of their interest by their inquiries as to the results of this campaign. With the idea of answering them with some degree of accuracy, a questionnaire was sent out to those in each county who had helped in this movement. The thirty-seven questionnaires returned from twenty-seven counties are an aid in determining whether the efforts and money expended have been rewarded by results that would justify a similar campaign another year. Those who look for statistical results within a few months after a campaign of this nature are liable to be disappointed, for seed-time and harvest are widely separated in human lives, and a mouth health week is seed-time, especially a first one.

*Supervisor, Division of Mouth Hygiene, Mississippi State Board of Health.

Mouth health week in Mississippi was launched by a resolution of the Mississippi Dental Association, passed in May, 1926. Volunteering their cooperation to the state board of health, the association proposed to pay half of the expenses involved, the total being estimated at $500. Due to the franking privilege which the division uses as part of the federal aid, the expenses ran very little over this amount, all the sum being spent for printing and engraving except two weeks' salary for an additional stenographer.

Drug store window display during Dental Health Week in Mississippi.

Since a description of the Texas and Pennsylvania Dental Health Weeks appeared in THE JOURNAL, part of the literature used in Mississippi has already been shown. Texas permitted us to copy the two placards: "Watch Your Teeth" and "Food and the Teeth." Indeed, Mississippi is indebted to good friends north, east, south and west for all of the plans and material for mouth health week except the "Boy poster." Minneapolis furnished the name, "Mouth Health Week," which seemed suitable since the division is "Mouth" hygiene and not "Oral" nor "Dental." The Pennsylvania and Texas programs were worked over to suit Mississippi needs, and Pennsylvania suggested

the organization, which is a permanent one. The state is divided into sixteen zones, with a dentist as chief of each one, and each county has a dentist as chairman of a committee, including the county health officer, the superintendent of education, the county health nurse, and the child hygiene chairman of the parent-teacher association. This committee has the privilege of admitting any other interested persons. Since the counties are largely rural, one county started a good plan by appointing a chairman for each voting precinct, thus insuring the distribution of literature.

One addition made to the programs used is characteristic of the mouth hygiene program in Mississippi. The superintendent of schools in each town where there is at least one dentist received a letter asking if he was interested in dental examinations in his schools. One hundred and fifteen such letters were sent. The dentists in these towns were sent a letter at the same time, and as a result many examinations were held. The fact that in 1924-1925 fifteen counties reported 14,321 children examined and in March, 1926, fifty-one counties reported 47,901 examined, indicates that the increase must be partly due to mouth health week. The percentage of "O.K." mouths last year was 29, and this year it is the same, although a great many more children have been examined.

In six counties, the examinations have been made by the county health officers without the dentists. In four other counties, where 12,575 children were examined, the dentists worked in cooperation with the county health unit, and in the forty-one remaining counties the dentists have made the examinations, assisted sometimes by the supervisor of mouth hygiene and sometimes by the parent-teacher association. While all of the dentists in the state are not enlisted in this volunteer service, many new recruits have been made this year. At least a dozen dentists have given their services yearly for the past decade, and altogether this is a splendid example of what can be done in a territory where less than 400 dentists are scattered over 46,362 square miles.

There were several weak points in the campaign: failure to encourage school children to write more articles and make more posters, and poor handling of newspaper publicity, and of displays in stores and motion picture houses were perhaps the greatest faults. This being the first campaign of its kind in the state, some dentists felt a hesitancy about urging the publicity. In several places, the parent-teacher association took the initiative and put on good programs. In one place, the president of this association secured the cooperation of a printer in making two slogans for her free, interested drug stores in making creditable displays, rented a dental film at her own expense, cleaned up the picture show house, and gave the children a free show, including a little play presented by one of their own school grades.

The president of a chain of drug stores in Jackson wrote eleven manufacturers and secured special window displays. The drug store display of another firm in Jackson was very effective, as shown in the accompanying photograph. Jackson, Meridian and Okolona used slides from the American Dental Association.

In Natchez, a prize of one dollar was offered for the best slogan produced in twenty-four hours.

From a public health nurse, who as-

sisted her county health officer and six dentists in examining 2,463 children in thirty schools, we have the following:

Pearl River County has been greatly benefited by mouth health week. We began by writing to the principal of each school asking them to cooperate with us in this campaign. We then asked the cooperation of the dentists, and all were glad to assist. The examinations were held at the schools, and dental lectures were given by the examiners at each visit. Dental posters were placed in the business houses in Poplarville and Picayune, and drug stores made special displays.

A prize was awarded to each grade in Poplarville Junior High School for the best dental poster, and each grade competed. In Picayune, the same program was carried out by the parent-teacher association. I do not know the exact number of brushes sold, but know that the majority of white school children now have toothbrushes. In some of the primary grades, where the children are not able to buy them, they were donated by teachers, druggists and dentists.

There are twenty-seven members of the Colored Mississippi Dental Society. Several of these were very much interested in Mouth Health Week. They examined more than 2,000 colored school children and put on good programs at churches and schools at their own expense.

As supervisor of mouth hygiene I have spent the school term in doing follow-up work where examinations were made and in launching them where schools desiring this service could not arrange to have it during mouth health week.

May the day come when every community will have a time set for these dental examinations and when each dentist in the state will feel that he has not done his bit until all school children in his community have had their annual dental examination.

FIELD NOTES*

A dental educational clinic has been established as part of the health program of Franklin County, Ohio. This is financed by funds from the Franklin County Health Board, the Franklin County Public Health Association, and the Ohio State Dental Society. Miss Caroline Longnecker, of Worthington, Ohio, a dental hygienist, graduate of Rochester Dental Dispensary, who has had two years of public health experience in the industrial field, is in charge of the county dental health program. This service was established as the result of a query to the county superintendent of schools, in which he was asked what phase of health work was needed most in the rural schools. Miss Longenecker's headquarters will be in Columbus and she will have charge of about 10,000 school children, attending eighty-two rural schools.

There are eleven states employing full-time dental directors, not twelve as announced in the March issue of THE JOURNAL. Oklahoma should not be in the list.

Mississippi is to be congratulated on having Dr. William R. Wright, of Jackson, appointed by the governor to serve as a member of the state board of health. Dr. Wright is also chairman of the Committee on Mouth Hygiene and Public Instruction and Trustee of the American Dental Association.

Scott County, Iowa, recently had a series of preschool dental clinics in the different towns. Through the invitation of the County Dental Society, G. H. Wandel, dentist, and Ethel Reuben, dental hygienist, from the division of maternal and infant hygiene of the state university, conducted the clinics. The work is financed by funds from the state and federal governments under the Sheppard-Towner Act. Dr. Wandel gave talks to the high school and seventh and eighth grade pupils, and a general community talk to adults every afternoon, met the local dentists at a weekly luncheon, and examined the teeth of children under 6 years of age who were brought by their mothers. Miss Reuben gave talks in the lower grades, conducted toothbrush drills, and gave prophylactic treatments.

*The Department of Dental Health Education will be glad to receive items of news along the lines of education in dental or general health.

Medical and Dental News

Arkansas

Northwest District Society Meets: The spring meeting of the Northwest Arkansas District Dental Society was held in Fort Smith, March 8. Among the speakers were Dr. W. T. Avery, who spoke on "Local Anesthesia and Exodontia, with Special Reference to Surgical Removal of Teeth," and Dr. T. E. Collins, who spoke on "Gold Inlay and Bridge Technique, with Special Reference to Modern Attachments to Vital Teeth;" both of Springfield, Mo.

California

University Charter Day: The University of California observed their charter day, March 23, with appropriate exercises. Dr. Michael Idvorsky Pupin, professor of electro-mechanics and director of Phoenix Research Laboratories in Columbia University, gave the address, in the Greek Theater.

Physicians Guests of Dentists: Members of the Alhambra Medical Society were guests of the Alhambra Dental Society, March 5, dentists from Pasadena, Glendale and Long Beach attending. F. W. Wood, M.D., spoke on "Surgical Procedure Becoming Necessary Because of Oral Infection;" P. H. Blong, M.D., on "Relation of Oral Infection to Systemic Disease," and R. A. Walker, M.D., on "Tooth Problems."

Colorado

Prevalence of Vincent's Infection: Prevalence of Vincent's infection, popularly known as trench mouth, has led the state board of health to ask that special precautions be taken to guard against its spread. Dentists and physicians are asked to report cases promptly.

District of Columbia

Sixth Postgraduate Clinic: The sixth postgraduate clinic of the District of Columbia Dental Society was held, March 24-26, with the following clinics: "Full Dentures," by Dr. Alexander H. Paterson, Baltimore, Md.; "Porcelain-Tip Fixed Bridgework," by S. D. Tylman, of Chicago, Ill.; "Amalgam Restorations," by S. B. Luckie, Chester, Pa., and "Oral Hygiene," by J. C. Hollister. At the regular monthly meeting, held preceding the clinic, at the George Washington University Medical School, Dr. Russell W. Tench, of New York City, spoke on "Full Denture Prosthesis—Some of Its Problems."

Georgia

Midwinter Clinic: With more than 500 dentists from twelve southern states, the midwinter clinic opened in Atlanta, March 18. Dr. Howard R. Raper, of Albuquerque, N. M., read a paper on "Something New in Radiodontia." Dr. C. Edmund Kells, of New Orleans, La., was honor guest at a banquet, March 18. The clinic was held under the auspices of the Fifth District Dental Society.

Illinois

Chicago Dental Society Meets: At the April meeting of the Chicago Dental Society, the following program was presented: "Report of Special Root Canal Therapy Committee," by Dr. J. R. Blayney, chairman; "Two Case Reports," by Louis Schultz, Sr. Dr. Schultz presented a case of removal of a large root cyst, and a case of reconstruction of the mandible by bilateral resection; both illustrated by slides.

Plans for Ward Memorial: In addition to the $4,000,000 contributed for the construction of a memorial building to house the medical and dental departments of Northwestern University, Mrs. Montgomery Ward has given $4,000,000 as an endowment fund. The first seven floors of the building are to be used by the medical department, the next six by the dental department. The fourteenth

floor will house a laboratory, to be used by both departments, and the five story tower will be used as administrative offices.

Dental Unit in New Hospital: The new Passavant Hospital, which is to be built opposite the Montgomery Ward Memorial Medical and Dental School of Northwestern University on ground contributed by the University, will maintain a dental operating and oral surgery unit, the first of its kind in Chicago. This was included in the plans at the suggestion of the Chicago Dental Society.

Sangamo-Menard Society Meets: The Sangamo-Menard County Dental Society met in Springfield, March 11. Dr. George M. Scott, of St. Louis, Mo., spoke on "Bridgework;" Dr. K. M. Knapp, of Minneapolis, Minn., on "Cavity Preparation," and Dr. Earl H. Thomas, Chicago, Ill., on "Dental Office Economics."

Chicago College Home Coming Clinic: The forty-third annual homecoming clinic of the Chicago College of Dental Surgery was held, April 12-13. A comprehensive program of clinics was presented and the following program of lectures: Dr. George S. Monson, St. Paul, Minn., on "Occlusion;" Dr. P. G. Puterbaugh, on "Pulp Canal Treatment;" Dr. William H. G. Logan, on "Oral Surgery Diagnostic Clinic;" Dr. Rea Proctor McGee, of Pittsburgh, Pa., on "The Demands of Present Day Dental Practice," and Dr. W. I. McNeil, on "Full and Partial Denture Castings."

Medical and Dental Student Home: A ten story Y.M.C.A. building for the use of students will be built shortly in the medical and dental center on the west side, Chicago. The first floor will contain a gymnasium, three hand-ball courts, four shops and a mechanical plant; the second, a cafeteria, clubrooms, lounges, offices, lockers, showers and spectator's gallery for the gymnasium. The third to the tenth floors will be occupied by 365 students rooms. The building is to cost $750,000. Students and faculty have raised $100,000. The project was started by a contribution of $50,000 by Dr. Truman W. Brophy, president of the Chicago College of Dental Surgery.

Senator Shipstead Speaks Against World Court: Senator Henrik Shipstead (D.D.S.) spoke at the Broadway Armory, Chicago, March 17, on "How to Get Out of the World Court."

INDIANA

Huntington Dentists Meet: The dentists of Huntington met, March 10, at a banquet, where the following plans were discussed: organization of a study club to consider problems and new developments in the profession; dental health education of the laity, with a school canvass for this purpose, and to examine the children's teeth; and observance of dental health week.

Ben Hur Society Meets: The annual meeting of the Ben Hur Dental Society of Crawfordsville was held April 14. Dr. C. R. Jackson, of Indianapolis, gave an address on "Orthodontia and the Dentist, from the Orthodontist's Viewpoint." Clinics were given by Drs. L. F. Smith and Chester Miller, of Indianapolis.

Western Indiana Dental Society Meets: The annual district convention of the Western Indiana Dental Society was held in Terre Haute, March 10-11. Dr. R. E. McBoyle of Chicago spoke at the banquet held the first evening of the convention. The second day was taken up with clinics. "Anesthesia" was the subject of a clinic conducted by Drs. Earl S. Gilchrist, E. A. Woods, H. C. Percival and R. T. Ross, all of Indianapolis, Ind. Other clinics included "Castings," by H. S. Hickman, "Wax Bite," by G. W. Russell, and "Anesthesia Using Nitrous Oxid," by F. P. Anshutz and C. E. Ragan.

IOWA

Joint Medical and Dental Meeting: A joint meeting of the Woodbury County Medical Association and the Sioux City Dental Society was held in Sioux City, March 16. Dr. R. A. Fenton, instructor in the Dental College of the University of Iowa, spoke on "Abscesses in Jaw Bones."

LOUISIANA

Midwinter Clinic: The Louisiana State Dental Society held its forty-seventh annual midwinter clinic, February 26-27, in New Orleans. Lectures and clinics were given by Drs. W. E. Harper, Chicago, Ill.; H. G. Mortonson, Milwaukee, Wis.; Olin Kirkland, Montgomery, Ala., and Boyd S. Gardner, Rochester, Minn.

MICHIGAN

District Society Elects Officers: The following were elected officers of the Jackson District of the Michigan Dental Society at

its recent meeting: president, Rollo Lawn; vice president, Russell E. Curtis; secretary-treasurer, Don C. Lyons.

Dr. Wright Addresses Physicians: At a meeting of the Berrien County Medical Society, March 18, at Benton Harbor, Dr. Chester F. Wright, of South Bend, Ind., spoke on "Preventive Dentistry."

Michigan State Dental Society Meets: The seventieth annual meeting and clinic of the Michigan State Dental Society was held in Detroit, April 12-14, with Dr. Clarence Cook Little, president of the state university the guest of honor. Dr. Chalmers J. Lyons, of Ann Arbor, spoke on "The Michigan State Department of Health;" Dr. Howard B. Lewis, professor of physiologic chemistry at the state university also spoke. Dr. J. R. Blayney, of Chicago, Ill., spoke on "Root Canal Therapy on a Biologic Basis," and Dr. Rupert E. Hall, of Chicago, gave a three-hour lecture and clinic on prosthetics.

Montana

Seventh District Society Meets: The annual convention and clinics of the Seventh District Dental Society was held, March 12-13, at Havre. The seventh district extends along the Great Northern Railway from Glacier Park to the Dakota line.

Dentists Study Plate Technic: At the regular monthly meeting of the Third District Dental Society, held in Anaconda, March 6, the Monson technic for making plates was demonstrated by Dr. M. C. Roberts of Butte. The programs of the monthly meetings, held in various towns in the district, are composed of a business session and a table clinic, held by one of the members, and demonstrating a particular method of plate making. At the next meeting, to be held in Butte, the Hanau technic will be demonstrated by Dr. Elmo G. Tucker, of Warm Springs.

New Jersey

New Jersey Lifts Ban on Dental College: According to reports, New Jersey has lifted the ban against the College of Dentistry of the University of Maryland under which students of that institution were prevented from taking the examination for license to practice dentistry in that state. Improvements in the curriculum have been assured the members of the New Jersey State Board of Registration and Examination in Dentistry, by the dean of the dental college. Consistent failure of students from the Maryland institution to pass the state board examination in New Jersey is said to have led to the action of the board, at a meeting held last January 9.

North Carolina

Second District Dental Society Meets: The annual meeting of the Second District Dental Society was held, March 8-9, at Charlotte. At a dinner in honor of visiting dentists, Dr. W. H. Frazer of Queens College was the speaker.

Semiannual Meeting of Cape Fear Dentists: At the semiannual meeting of the Cape Fear Dental Society, in Fayetteville, March 13, clinics were held by Dr. J. W. Whitehead, of Smithfield, on full dentures, and Dr. J. R. Butler, of Dunn, on removal bridgework. The next semiannual meeting will be held in Clinton in September.

New York

Ninth District Dental Society Meets: The annual meeting of the Ninth District Dental Society was held in Newburgh, N. Y., April 10. The essayist of the day was Dr. George Wood Clapp, of New York City, who spoke on "Economic Element in Professional Success."

Ohio

Cleveland Dental Society Meets: At the April 5 meeting of the Cleveland Dental Society, Dr. John J. Travis, of Ann Arbor, Mich., presented a paper on "Cavity Preparation in Vital Teeth." Dr. S. W. Brown, of Ashtabula, Ohio, spoke at the midmonth meeting, April 19, on "Temporary Protection of Vital Teeth During Construction of Large Restorations."

Oklahoma

State to Appeal Court Ruling: It is reported that the Oklahoma State Board of Dental Examiners will appeal from a decision of the Oklahoma County District Court holding the law creating the board and giving it its power unconstitutional. The ruling was made by the district judge in a suit brought by Leo L. Pollock, who is practicing dentistry in Oklahoma City. The latter opened a fight against the state board in May, 1925, when he sought an injunction to prohibit an investigation of himself by the board. This was denied, and Dr. Pollock's license was revoked, and the ruling was later affirmed by a board of appeals consisting of the attorney general, the governor and a member of the supreme court. Since then, it is said that Dr. Pollock has been arrested three times for practicing

without a license, but has not been tried on the charges pending the outcome of his injunction suit above referred to.

Pennsylvania

Tri-County Dental Society Meets: The first annual clinic of the members of the dental society composed of Fayette, Westmoreland and Washington county dentists was held, March 16, at Greensburg. Drs. L. W. Ohl, of Pittsburgh, J. C. Logan, of Portage and C. J. Hollister, of Harrisburg, took part in the program.

Philadelphia Dental College Alumni Meets: The Philadelphia Dental College Alumni held their sixty-third annual reunion, Wednesday, April 21, with a program of essays and clinics. The meeting closed with a banquet.

South Dakota

Sixth District Dental Society Meets: The Sixth District Dental Society met at Sioux Falls, March 17, in their annual spring conclave. Dr. James W. Prime of Omaha, Nebr., spoke on preventive dentistry. The session continued through the day, and the annual banquet was held in the evening.

Texas

Dallas Society Installs Officers: March 4, the following officers were installed by the Dallas County Dental Society: president, S. L. Barron; president-elect, A. L. Nygard; vice-president, M. G. Musick; secretary-treasurer, Lee Willard Ogle, (reelected).

Virginia

Joint Society Meeting: A joint meeting of the North Carolina Dental Society and the Virginia State Dental Association was held in Richmond, April 13-15. In addition to an extensive program of clinics, the following lectured on their various specialties: Dr. Thomas W. Murrell (M.D.), Richmond, Va.; Dr. Herbert A. Potts, Chicago, Ill.; Dr. J. Ben Robinson, Baltimore, Md.; Dr. Clyde M. Gearhart, Washington, D. C.; Dr. James A. Blue, Birmingham, Ala.; Dr. Walter T. McFall, Greenville, S. C.; Dr. I. Lester Furnas, Cleveland, Ohio; Dr. Alfred Owre, Minneapolis, Minn.; Dr. James K. Burgess, New York City; Dr. A. O. James, Richmond, Va.; Dr. R. M. Olive, Fayetteville, N. C., and Dr. W. H. O. McGehee, Cleveland, Ohio. Trap shooting and golf were features of the entertainment.

Washington

Dr. Oliver Honored: Forty local dentists uniting in honoring Dr. A. Starke Oliver of Spokane on his recent retirement after thirty years in practice in Spokane. Dr. Oliver is past president of the Spokane County Dental Society and an honorary member of the Washington State Dental Association. He was given a handsome remembrance in token of his services in organization and in securing dental legislation.

General

American Association of Dental Schools Meets: The third annual meeting of the American Association of Dental Schools was held in Chicago, March 24-26. Attention was given to a study of teaching methods, as regards conservation of time, coordination with basic principles and most effective results. "Principles of Curriculum Construction in a College of Dentistry" was the subject of an address by Dr. Austin G. Schmidt, professor of education in Loyola University, Chicago, Ill. An analysis of a proper course in operative technic, including dental anatomy, contents and why, years, order of presentation of pieces, reasons therefor and time allotted for each was presented by Dr. Erling Thoen, Iowa City, Iowa. A corresponding analysis of prosthetic technic was given by Dr. Alexander H. Patterson, Baltimore, Md., and of crown and bridge technic by Dr. A. L. King, Atlanta, Ga. Dr. Henry J. Prentiss, Iowa City, discussed the teaching of anatomy to dental students—time allotment, contents and why; Dr. Arthur C. LaTouche, Los Angeles, Calif., the teaching of operative dentistry in the clinic; Dr. W. H. Wright, Pittsburgh, Pa., the teaching of clinical prosthesis in the dental school, and Dr. R. E. MacBoyle, the teaching of crown and bridge work in the clinic. The following officers were elected: president, H. E. Friesell, Pittsburgh, Pa.; president-elect, William H. G. Logan, Chicago, Ill.; vice-president, Lewis E. Ford, Los Angeles, Calif.; secretary-treasurer, DeLos L. Hill, Atlanta, Ga.

First Meetings of House of Delegates of International Congress: The Board of Trustees of the American Dental Association, at the meeting held recently in Chicago, selected August 21 (Saturday), as the date for the first two meetings of the House of Delegates to the Seventh International Dental Congress, which convenes in Philadelphia, August 23-27, 1926.

Regulations Drafted For Tetraethyl Lead Gas: Tentative regulations governing the manufacture, distribution, and use of tetraethyl lead gas and suggestions for regulations covering the sanitation of garages have been submitted by Surgeon General Cumming, of the United States Public Health Service, to the health officers of the various states for their consideration, comment and criticism. These regulations, when finally adopted, will mark a distinct step forward in the safeguarding of the manufacture and handling of dangerous chemicals. Of far more importance to industrial workers than the control of the manufacture of tetraethyl lead is the suggestion for regulations covering the sanitation of garages. During the recent investigations of the United States Public Health Service of the possible health hazard from the use of tetraethyl lead gasoline, it was found that lead was present in the dust of ordinary garages, and in one instance it formed as much as 1 per cent of the total inorganic matter. When one considers that there are hundreds of thousands of garage workers, the extent and well-nigh universal distribution of this health hazard is at once apparent, and the necessity for sanitary regulation obvious.—*Bull. U. S. Pub. Health Service.*

Army Dental School Graduation: The graduation exercises of the Army Dental School, together with the Medical and Veterinary schools, were held, February 10, in the Red Cross House, Army Medical Center, Washington, D. C. The honor graduates of the dental school were Captains James B. Mann, who received the Dental Corps Medal, and Vivian Z. Brown. Others graduating were Captain Ernest P. Dameron and First Lieutenants Everitte F. Arnold, James M. Epperly, James H. Pence and Mack J. Real.

Deaths

Bishop, P. D., Andover, Ohio; died, March 17.

Drake, Homer A., Chicago, Ill.; University of Michigan, College of Dental Surgery, 1885; died March 14; aged 66. Dr. Drake was widely known as a bandmaster.

Duden, Alice G. Harvie, Indianapolis, Ind.; Temple University School of Dentistry, 1903; died, March 31. Dr. Duden had practiced dentistry in Indianapolis for nearly twenty years.

Lauer, Vern G., Minneapolis, Minn.; University of Minnesota, College of Dentistry, 1918; died, March 2, from accidental gas poisoning; aged 30.

Parr, H. I., Spokane, Washington; Kansas City Dental College, 1885; died, March 13, after a brief illness; aged 66.

Walker, Donald M., Cleveland, Ohio; University of Toronto, Dental Department; for twenty-five years a practicing dentist in Cleveland, died, March 15; aged 60.

THE GORGAS MEMORIAL INSTITUTE

By FRANKLIN H. MARTIN*, M.D., Chicago, Illinois

The purpose of the Gorgas Memorial Institute is to carry on an aggressive, continuous educational campaign against unnecessary illness and premature death. It is established for this purpose by leaders in medicine and dentistry and by laymen of national reputation, and has been named in honor of Gen. William Crawford Gorgas, the great soldier, sanitarian and "physician to the world."

Measured in dollars, admittedly but a part of the sum, it cost the people of the United States each year $3,000,000,000 for the luxury of unnecessary sickness and premature death. On any given day 3,000,000 people are ill, from 750,000 to 1,000,000 needlessly so.

The span of life today is 58 years. When the individual man, woman, and child has grasped the idea that he is largely responsible for his good health or his bad health, life will be happier, more enjoyable, more productive and longer. Fifteen years added to existence within the next half century is not too much to expect. All thinking men admit the need for improvement all along the line.

The middle span of life is today particularly a problem. Here people are dying of the so-called degenerative diseases, the conquest of which lies not in laws but in education. The annual health audit would detect illness before it is "too late." As the problem is studied, it becomes more evident that health education by reputable physicians and dentists is the need. In the past, public ignorance has been fostered by professional reticence. But such reticence will not reduce morbidity nor add to the span of life. Nor will it add one iota to the happiness of humanity.

It is time, therefore, that reliable health information be made available to the people by the members of the two professions themselves—in the newspapers and magazines, over the radio and in public addresses. At a later date, it is the intention to employ the motion picture in health educational work, and in a fashion far different from that in which it is employed today.

Commenting on the present scope of the work, a great editor, nationally respected, recently said: "The Gorgas Memorial is now conducting the greatest educational campaign ever attempted in America."

The three cornerstones of preventive medicine are naturally the physician, the dentist and the individual. The dentist and the physician are the men who must be depended on to teach preventive medicine by personal contact. They must conduct examinations that will make life both broader and longer. Success cannot come without friendly cooperation.

Three-fifths or more of the income from the $5,000,000 endowment that is to be raised will be devoted to the educational work herein briefly sketched. The remainder will be devoted to research in tropical diseases in Panama, where the Republic of Panama has donated a site and has voted $750,000 for the construction of Gorgas Memorial laboratories.

Calvin Coolidge is honorary president of the Gorgas Memorial Institute. When informed of the progress that the Institute had made, on the occasion of the last directors' meeting in Washington, he wrote:

"Human misery and the enormous economic loss caused by preventable illness are matters of serious moment to every individual. The Gorgas Memorial's plan to conserve this needless waste of human resources is com-

*President, Gorgas Memorial Institute.

mendatory and deserving of the support of all thinking people."

Among the directors are: Vice-President Charles G. Dawes, Bernard Baruch, Hon. R. J. Alfaro, Panamanian minister, George W. Crile, M.D., Surg. Gen. Hugh S. Cumming, William F. Green, president of the American Federation of Labor, William D. Haggard, M.D., president of the American Medical Association, W. P. G. Harding, governor of the Federal Reserve Bank, Maj. Gen. Merritte W. Ireland, Surgeon General United States Army, Rudolph Matas, M.D., president of the American College of Surgeons, W. H. G. Logan, M.D., D.D.S., William J. Mayo, M.D., John R. McQuigg, National Commander, American Legion, C. Jeff Miller, M.D., Judge John Bassett Moore, Brig. Gen. Robert E. Noble, Stewart Roberts, M.D., John W. O'Leary, president of the United States Chamber of Commerce, Hugh H. Young, M.D., Prof. C. E. A. Winslow, president of the American Public Health Association, Rear Admiral Edward R. Stitt, United States Navy, George David Stewart, M.D., Alfred Stengel, M.D., president of the American College of Physicians, Adolph S. Ochs, editor of the *New York Times*, Ernst A. Sommer, M.D., Leo S. Rowe, director-general of the Pan-American Union, James B. Brown, Gilbert FitzPatrick, M.D., Tyson Dines, attorney, Edwin W. Ryerson, M.D., George E. de Schweinitz, M.D., Belisario Porras and George M. Reynolds, chairman of the board of the Continental and Commercial National Bank, Chicago.

The American Dental Association is represented on the board of directors by W. H. G. Logan and by Sheppard W. Foster, president of the American Dental Association.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Tragedies of Tooth Extraction: Four cases of general sepsis and infectious degenerative processes developing after extraction of teeth or after the treatment of a root abscess and resulting fatally are reported by George Blumer (*Boston M. & S. J.*, Feb. 11, 1926), under the title "Tragedies of Tooth Extraction." In every case, the patient was already suffering from some serious pathologic condition. The author groups the different types of fatal lesion which may result from tooth infection as follows: 1. Direct extension of the local inflammatory process with spreading inflammation, which may even invade the mediastinum, and death from toxemia. 2. Metastasis to neighborhood tissues such as occurs in cases of meningitis or thrombosis of the cerebral sinuses after tooth extraction. 3. General septicemia or septicopyemia, which may terminate in *(a)* acute septicemia with or without endocarditis; *(b)* chronic septicemia with degenerative processes in the internal organs, or *(c)* prolonged septicopyemia with the formation of abscesses. The author states in conclusion that while he is not pleading against extraction of infected teeth, in cases of chronic disease with lowered resistance great care must be observed in extraction. He questions the advisability of curettage, which facilitates drainage but adds to the trauma but concludes that the latter is considerable enough in any case that curettage probably does not add appreciably to the risk.

Cleft Palate Work: The object in cleft palate work should be to have a velum as near the normal arrangement as compatible with the local deformed conditions; one that is pliable and free from scars. Since there is no bony attachment in midline, this is best accomplished by having a common tendinous center for the attachment of the muscles. This may be done by using the aponeurosis of the palate, which gives broad raw surfaces for fusion across the cleft, preserves the normal laminated arrangement of the muscles, and leaves their normal innervation intact. This makes for symmetrical action of the muscles and more normal pronunciation.—R. B. Cates, in *Boston M. & S. J.*

Relief for Pain in Carcinoma of the Face: Relief of the pain attending carcinoma of the face is reported by F. C. Grant (*J.A.M.A.*, Jan. 16, 1926) in a series of cases, in which blocking of the sensory nerves was employed. In the majority of cases, the trigeminal nerve was blocked, as this was the source of the sensory supply of the area involved. Blocking of the glossopharyngeal nerve was necessary when the tonsil or base of the tongue was involved. The cervical nerves demand blocking in growths lying below the level of the mandible. In two cases in which malignant growths in the neck had so deeply involved the structures that dissection of the superficial nerves was not advisable, laminectomy was performed and the posterior roots of the first, second and third cervical nerves were sectioned intradurally where they leave the cord. In dealing with pain referred to the trigeminal distribution, intracranial neurectomy is the procedure of choice, but peripheral injection is more frequently employed, for patients dread the formal operation. Of thirty-five patients, twenty-one were entirely freed from pain and six much improved, and eight showed no change. In five of the eight, the lesion was in the floor of the mouth, with involvement of the tonsillar pillar, and three had extensive degeneration of the maxillary bone and adjacent accessory sinuses. The author concludes: "Nerve blocking of the branches of the trigeminus for the relief of pain from cancerous lesions about the face is an act of mercy. It does not cure the lesion. Often that is impossible, but it makes the sufferers' last days comfortable. If a man or woman is doomed to die from cancer of the face—and it is a slow, lingering, miserable way to perish—it is cruel for us to deny them any

treatment that may ease them on their way and relieve even a part of their anguish."

Avenues of Infection: The teeth constitute but one group of a number of avenues by which infections may enter the body. They are probably an important group but in every case of suspected systemic infection the tonsils, the sinuses and the various other portals of the body should be given equal consideration. There is evidently a direct relationship between infection of the tonsils and infections of the teeth. When both the teeth and tonsils are infected, permanent relief will usually not be attained until both sources of infection have been eradicated. If there is a reasonable doubt concerning the presence of dental infection, all other possible sources of infection should be definitely ruled out before drastic action in regard to the teeth is adopted. It is obvious that known cases of root-end infection or pyorrhea should be eliminated by proper treatment or by extraction of the teeth. This is true of people who are well as also of those who are sick. However, thousands of people have carried pulpless teeth in their mouths for a greater part of their lives and have had no indication of harm therefrom.—R. M. Bunting, in *Public Health.*

Relation of Trauma to Malignant Tumors: In a discussion of the relation of trauma (here defined as a single or repeated mechanical injury resulting in contusion, crushing or laceration of the tissues) to malignant tumors, James Ewing (*Am. J. Surg.*, February 1926) cites numerous cases in which the trauma accredited with causing the lesion to develop was but coincidental with some deeper lying condition long present. Cancer, he states, is essentially a disease of habit, e. g., the victim of mouth cancer continually irritates the tongue with a sharp tooth and tobacco juice. However, cases of cancer due to habits associated with the industries are rare, as the laboring class are relatively free from cancer. According to the best American practice and European rulings and statutes, the following conditions must be provided before trauma can be accepted as the cause of a tumor: 1. Authenticity and sufficient severity of the trauma. 2. Previous integrity of the wounded part. 3. Identity of injured area with that giving origin to the tumor. 4. The tumor must be of a type that could conceivably result from trauma. 5. There must be a proper time interval between the receipt of the injury and the appearance of the tumor. Experimental efforts to produce cancer by various forms of single trauma have met with no success.

Cancer Problems of Mouth and Face: In consideration of cancer in any of these fields, we must have in mind the differential diagnosis of carcinoma, late syphilis, leukoplakia, tuberculosis and actinomycosis. Yet, the purpose of this discussion is not only to stress differential diagnosis of these lesions, but to urge the importance of always recognizing a deviation from normal of these structures, that the patient may have the benefit of your professional advice, and seek relief before becoming afflicted with definite malignancy, which may prove fatal. At the present time, cancer may be said to be curable in the beginning in a majority of cases, but the beginning is definitely past when the structures are extensively involved and the glands in the field have become affected. The late John B. Murphy laid down the five following laws having reference to the problem of cancer: 1. Repeated mild traumas and irritations, particularly at the border line of different epithelial fields and cicatricial tissue, are potent etiological factors in carcinoma. 2. Moderately severe traumas once applied never produce carcinoma. 3. Moderately severe traumas—not to a degree of laceration or fracture—are frequently the cause of sarcoma and the precipitation of tuberculosis. 4. Severe traumas to the degree of laceration or fracture never cause carcinoma, sarcoma, or focalized tuberculosis. 5. Sudden changes in conformation and vascularity, embryonal defects, pigmented moles, warts, papillomas or cutaneous fibromas usually indicate beginning malignancy and always demand immediate removal.—William H. G. Logan, in *Dent. Sci. J. Australia.*

Evaluation of Surgical Risk: In a systematic effort to determine how much damage is involved in an ordinary surgical procedure and what findings are to be looked on as of more sinister significance in evaluating operative risk, F. F. Gundrum and J. B. Harris (*Cur. Res. Anes. & Anal.*, February, 1926) made a record of 400 cases as to preoperative condition, covering age, sex, hemoglobin, blood pressure, size, rate and valvular condition of the heart; and lung and urinary findings. Operation was postponed in 3 per cent of cases because of acute heart or chest conditions. Mortality (22 per cent) was due

to pneumonia, peritonitis, hemorrhage and Addison's disease. These cases may be further classified as due to (1) surgical failure, 30 per cent; (2) poor medical judgment, 14 per cent; (3) surgical calamity, 28 per cent; (4) unavoidable because of condition present, 28 per cent. This classification, however, the author states, gives a very inaccurate picture of the problem because they are emergency cases. The cases were included in the report simply because the operative risk had been estimated. Conclusions reached are as follows: 1. Ordinary surgical procedures, well done, exhaust but a small percentage of the vitality of the average patient. 2. Heart abnormalities (without heart failure) did not seriously increase the surgical risk. 3. Bronchitis and emphysema proved to increase notably postoperative dangers. 4. High blood pressure *per se* did not indicate markedly greater danger, but low pressure increased the postoperative risk. 5. Low hemoglobin values added to the surgical risk. 6. It was impossible to devise any formula for indicating operative risk. Clinical judgment proved the best index to surgical and postoperative risks.

Heart Disease: Dyspnea, edema and sleeplessness, with a hopeless attitude on the part of the patient, his family and his physician, make up the picture of advanced heart disease. Fully as distressing, in a slightly different way, are the conditions surrounding cardiac decompensation in nearly any stage. Fifty per cent of the cases occur in persons who should be in the prime of life, with earning capacity and family expenses both at their highest. As a result of heart disease, all of those afflicted are partially or wholly disabled, and the families of a third of them are partially or wholly dependent on charity. McLean suggests, in the first number of the new periodical devoted to diseases of the heart, "Let us learn the lesson taught by the tuberculosis campaign, that we have not materially lessened the number of tubercle bacilli, but have lessened the fields on which they could grow." He would prevent heart disease through increasing resistance to communicable illnesses—the frequent precursors of cardiac disease. School children would be the beneficiaries of his campaign by yearly examination of all pupils between the ages of 6 and 12, first, to discover defects; secondly, to note the results of efforts at correction. "The tuberculosis campaign took twenty years," he says, and he prophesies optimistically that "the heart disease campaign will probably not take quite so long."—*J.A.M.A.*

Preparation for Anesthesia in Cardiac Conditions: In the preparation of substandard risks for operations, the patient should be conditioned and "pointed" for the day of operation as an athlete is coached for a strenuous contest. The operation should be deferred just as long as there is any prospect of further improvement in the patient's condition and no longer. Rest, digitalis and morphin judiciously employed are the sheet anchors upon which we must largely depend in the preparation of the bad risk cardiac cases for operation. The therapeutic value of rest and digitalis cannot be overemphasized. The preoperative use of morphin is not so generally accepted as it should be Morphin increases the safety of all general anesthesias by diminishing fear, controlling reflexes, stabilizing blood pressure and reducing the amount of anesthetic required.—John Russell, in *Cur. Res. Anes. & Anal.*, February, 1926.

Ethylene Anesthesia: M. Papin of Paris has employed for the last two years, ethylene anesthesia in all his urologic operations, and at the recent French congress of urology, he gave an account of his experiences. He has completely abandoned chloroform and ether anesthesia, and rarely uses local, regional or intraspinal anesthesia. A perfect general anesthetic is one that is effective and harmless. For a period of two years, Papin used nitrous oxid, which has the advantage of being much less dangerous than chloroform and ether, but it is not so effective an anesthetic as ethylene. After a number of trials on animals, the author began, together with Ambard, to use ethylene in operations on man. After having used ethylene in 700 cases, he affirms that it presents no disadvantages. It is mixed with oxygen in much the same manner as nitrous oxid; its use requires a certain amount of experience. Before ethylene is administered, a subcutaneous injection of pantopon is given, which suppresses the period of excitation, commonly slight at the worst. Anesthesia is complete in from one to twelve minutes—an average of five minutes. The awakening is without agitation or vomiting, as a rule. While vomiting does occur in a small percentage of cases, it is very slight. Ethylene does not affect the function-

ing of the kidneys. With the aid of this anesthetic, Papin has been able to operate on patients presenting rather marked general symptoms of nephritis, bad pulmonary conditions and somewhat grave cardiac lesions—in fact, in many groups of patients that he never would have risked subjecting to chloroform or ether. Ethylene is, however, highly inflammable, and, when mixed with oxygen, explodes with a loud detonation on coming in contact with a flame; but one needs only to take the same precautions as with ether in order to prevent accidents. Aside from this objection, Papin regards ethylene as the best of the anesthetics used in urology.—Paris Letter, *J.A.M.A.*

Osteomyelitis of Femur, Radius and Mandible: A case of osteomyelitis of the femur, radius and mandible in which recovery resulted after operation on the three foci of infection within seventy-two hours is reported by Louis Carp (*Am. J. Surg.*, February, 1926). The cultures from the three wounds grew *Staphylococcus aureus*. Intravenous dye medication was given, but it was found that the blood culture was already negative.

Osteomalacia in China: The ordinary food of the people is a meager diet of cereals with a limited amount of vegetables; no meat as a rule; no eggs, and but little animal fat. The oil used for cooking is vegetable in origin. The principal article of the diet is millet, which is eaten at least once a day in the form of a thin gruel made of whole seeds which are partially hulled and boiled in water, sometimes with a few small pieces of onion or garlic. A small quantity of salted bean leaves or turnips preserved in brine will be eaten with the gruel as a relish. From fifteen to twenty grams will be eaten with the gruel at one meal. Steamed bread of wheat flour is used once a day by those who can afford the luxury; or noodles are made of soy bean flour to which about 25 per cent of wheat flour is added. Oatmeal flour is used at times. The Chinese celery cabbage eaten in large quantities throughout China is not available to poor people here. Soy beans are pickled as a relish as are the leaves and stalk of the mustard plant and a kind of gourd which grows well on the highlands. All the patients studied showed a calcium content of the blood less than half of normal percentages. Phosphorus also was quite deficient in some cases. Clinical improvement followed when the diet was corrected by the addition of cod-liver oil.—Maxwell and Miles, in *Proc. Roy. Soc. Med.*, abstr. *Nation's Health.*

Ludwig's Angina: In a report based on twenty-three cases of Ludwig's angina, C. F. Yerger (*Ill. M. J.*, February, 1926) states that the primary focus of infection is most often some dental or peridental condition, such as caries of a lower third molar, alveolar abscess or infection following extraction. The organism involved is the streptococcus, alone or associated with other bacteria, especially the staphylococcus. The disease commences as a painful, tender, indurated swelling in the submaxillary region; within twelve to forty-eight hours, the floor of the mouth becomes raised by an indurated swelling and the tongue is pushed upward and backward against the roof of the mouth; the mucosa of the floor of the mouth may be elevated to the level of the free edges of the lower teeth. Speech and deglutition become difficult; the patient may be able to open the mouth with difficulty. When trismus is present, it is difficult or impossible properly to examine the buccal, pharyngeal and laryngeal cavities. The salivary secretion is markedly increased, causing the saliva to dribble. Dyspnea, insomnia, prostration or delirium may be present. Fever may be present or absent. If both sides of the neck are involved, the pressure symptoms as the result of involvement of the pharynx and larynx are intensified. Of fifty cases admitted to Cook County Hospital which were diagnosed as Ludwig's angina, but twenty-three, or 46 per cent, could be classified according to Ludwig's definition. The mortality was 43 per cent. Tracheotomy was done in three cases. The proportion of males to females was 10 to 1; the ages ranged from 7 to 56 years; the great majority of the cases being evenly distributed among the third and fourth decade. Bad dental hygiene was by far the most common cause. Sometimes it followed extraction of a lower molar. In all of the twenty-three cases, there were associated a woody phlegmon, in the submaxillary region, swelling of the floor of the mouth and dysphagia. In 33 per cent of the cases, dyspnea was present in varying degrees.

Announcements

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Academy of Periodontology, August 20-21, 1926, New York City.

American Dental Assistants Association, August 19, 1926, Philadelphia, Pennsylvania.

American Dental Golf Association, August 23, 1926, Philadelphia, Pennsylvania.

American Dental Hygienists Association, August 23-28, 1926, Philadelphia, Pennsylvania.

American Society of Orthodontists, August 16, 1926, New York City.

International Orthodontic Congress, August 16-20, 1926, New York City.

Pacific Coast Dental Conference, June 21-26, 1926, Portland, Oregon.

Seventh International Dental Congress, August 23-27, 1926, Philadelphia, Pennsylvania.

Canadian Dental Association, August 16-19, 1926, Halifax, N. S.

Ontario Dental Association, May 17-20, 1926, Toronto, Canada.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

National Capital at Washington, D. C., first Tuesday of every month.

May (1926)

Arkansas, at Little Rock (17-19).
Illinois, at Springfield (11-13).
Indiana, at Indianapolis (17-20).
Iowa, at Des Moines (4-6).
Maryland, at Baltimore (3-5).
Massachusetts, at Boston (3-7).
Missouri, at Jefferson City (17-19).
Nebraska, at Lincoln (17-20).
New York, at New York City (19-22).
North Dakota, at Grand Forks (18-20).
South Carolina, at Columbia (10-12).
South Dakota, at Sioux Falls (11-13).
Southern California (17-20).
Tennessee, at Nashville (4-7).
Vermont, at Burlington (26-28).
West Virginia, at Clarksburg (17-19).

June (1926)

California, at Portland, Ore.
Colorado, at Colorado Springs (9-12).
Georgia, at Savannah (9-11).
Maine, at South Poland (21-23).
Montana, at Helena (15-17).
New Mexico, at Santa Fe (10-15).
Oregon, at Portland.
Washington, at Portland, Ore. (21-26).

July (1926)

Wisconsin, at Milwaukee (13-15).
Wyoming, at Lander (12-13).

August (1926)

Pennsylvania, at Philadelphia (23-27).

October (1926)

Florida, at Daytona.

November (1926)

Arizona, at Phoenix.

December (1926)

Nevada, at Reno (4).
Ohio, at Columbus (7).

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

Dental Hygienists Association of the State of New York, at New York City, May 20-22, 1926.

Odontological Society of Western Pennsylvania, at Pittsburgh, November 29-December 1, 1926.

Northern Ohio Dental Association, at Cleveland, June 7-10, 1926.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Alabama, June 21, 1926. Secretary-treasurer, E. W. Patton, 725 First National Bank Building, Birmingham, Alabama.

Arkansas, at Little Rock, June 21-25, 1926. Secretary, Walter E. Hutchinson, Dermott, Arkansas.

California, at San Francisco, May 29, and at Los Angeles, June 26, 1926. Secretary, O. E. Jackson, 155 Kentucky Street, Petaluma, California.

District of Columbia, at Washington, D. C., June 14-18, 1926. Secretary-treasurer, C. Williard Camalier, Medical Science Building, Washington, D. C.

Florida, at Jacksonville, June 22-26, 1926. Secretary, R. P. Taylor, 114 St. James Building, Jacksonville, Florida.

Indiana, at Indianapolis, June 14, 1926. Secretary, J. M. Hale, Mt. Vernon, Indiana.

Iowa, at Iowa City, June 1-4, 1926.

Kentucky, at Louisville, June 1, 1926. Secretary, J. H. Baldwin, 908 Francis Building, Louisville, Kentucky.

Maine, at Augusta, June 24-26, 1926. Secretary, G. W. MacKay, Millinocket, Maine.

Maryland, at University of Maryland, June 2-4, 1926. Secretary, T. L. McCarriar, 1822 North Charles Street, Baltimore, Maryland.

Michigan, at Ann Arbor, June 7-12, 1926. Secretary, J. W. Lyons, 617-621 Dwight Building, Jackson, Michigan.

Minnesota, at University of Minnesota, June 15, 1926. Secretary, F. E. Cobb, 601 Donaldson Building, Minneapolis, Minnesota.

Mississippi, at Jackson, June, 1926. Secretary, Reuel May, Jackson, Mississippi.

Montana, at Helena, July 12-16, 1926. Secretary, Marshall E. Gates, Helena, Montana.

Nevada, at Reno, May 12, 1926. Secretary, G. H. Marven, Reno, Nevada.

New Jersey, at Trenton, June 28-July 3, 1926. Secretary, John C. Forsyth, 148 W. State Street, Trenton, New Jersey.

New Mexico, at Santa Fe, June 10-12, 1926. Secretary, J. J. Clarke, Artesia, New Mexico.

North Carolina, at Raleigh, June 14, 1926. Secretary, F. L. Hunt, Asheville, North Carolina.

Ohio, at Columbus, June 21-26, 1926. Secretary, Ray R. Smith, 327 E. State Street, Columbus, Ohio.

Oklahoma, at Oklahoma City, June 21-24, 1926. Secretary-treasurer, Charles A. Hess, Idabel, Iowa.

Rhode Island, at Providence, June 22-24, 1926. Secretary, Albert L. Midgley, 315 Butler Exchange Building, Providence, Rhode Island.

South Carolina, at Greenville, June 22-26, 1926. Secretary, W. B. Simmons, 107 E. North Street, Greenville, South Carolina.

South Dakota, at Sioux Falls, June 28, 1926. Secretary, G. G. Kimball, Mitchell, South Dakota.

Tennessee, at Nashville, June 21, 1926. Secretary-Treasurer, F. W. Meacham, 911 Hamilton National Bank Building, Chattanooga, Tennessee.

Texas, at Houston, June 7-9, 1926. Secretary, G. C. Baker, Kaufman, Texas.

Wyoming, at Cheyenne, June 28-30, 1926. Secretary, Thew J. Ice, Lock Box 116, Powell, Wyoming.

Department of Registration and Education, State of Illinois, at Chicago, June 15-19, 1926. Superintendent of Registration, V. C. Michels.

THE DENTAL SOCIETY OF THE STATE OF NEW YORK

PRELIMINARY PROGRAM

The fifty-eighth annual meeting of the Dental Society of the State of New York will be held at the Hotel Astor, New York City, May 19-22, 1926.

The literary exercises, clinics and exhibits will be held at the Hotel Astor. Dr. A. C. Bennett, 576 Fifth Avenue, New York City, is chairman of the exhibits committee, and those desiring space should communicate with him immediately. Dr. Frederick H. Adams,

8 West Fortieth Street, New York City, is chairman of the clinic committee.

The executive council will convene for the transaction of the business of the Society at 10 a.m., May 19.

Educational courses will be given May 17-19, prior to the regular session of the state society. Applications for registration in Courses 1 and 2, extraction and anesthesia, should be made to Dr. Adolph Berger, 10 East Seventy-Fourth Street, New York City. Applications for the other courses, consisting of root canal therapy, radiography, dental ceramics, shoulder crowns, the use of porcelain, removable bridgework, movable removable bridgework, dental anatomy, fixed bridgework, various technics essential to bridgework, full denture construction, partial denture construction and the treatment of periodontoclasia and orthodontia, should be made to Dr. Edward Kennedy, 347 Fifth Avenue, New York City. Full information with reference to these courses will be furnished on application. A cordial invitation is extended to the members of other state societies to avail themselves of the opportunity to take these educational courses.

LITERARY PROGRAM

May 19-22, 1926

"A New Research on Dental Caries"—By Dr. Percy Howe, Boston, Mass.

"Interpretation of Pains About the Head"—By Dr. Frederick B. Moorehead, Chicago, Illinois.

"Some Common Diseases of the Oral Mucous Membrane and the Tongue"—By Dr. Hermann Prinz, Philadelphia, Pa.

"Rehabilitation of the Mouth with Gold"—By Dr. Arthur C. Smith, Peoria, Ill.

Research Commission Report.

"Cure of Focal Infections"—By Dr. M. L. Rhein, New York City.

"Removable Bridgework, Showing Some New Devices and New Arrangements of Old Devices"—By Dr. Charles F. Ash, New York City.

"Indications for and Limitations of Alveolectomy"—By Dr. Victor Sears, New York City.

"Indications for and Limitations of Apicoectomy"—By Dr. Adolph Berger, New York City.

"Correction of Maxillary and Palatal Defects Preparatory to Prosthetic Restoration"—By Dr. Harold S. Vaughan, New York City.

"Prosthetic Restoration After Surgical Treatment War Time Work," (Lantern Slides)—By Dr. Joseph D. Eby, New York City.

"Prosthetic Restoration After Surgical Treatment, Peace Time Work," (Lantern Slides)—By Dr. Edward Kennedy, New York City.

There will be an oral health dinner at the Hotel Astor during the meeting of the society. It is expected that there will be many most attractive feaures in connection with this dinner. Prominent public officials are expected to be present, and the addresses and demonstrations will be of the very highest order.

During the time of the meeting of the New York State Dental Society, sessions of the New York State Dental Hygienists Association and the Dental Assistants Association will be held.

Every effort is being put forth to make this meeting one of the most attractive in the history of the society. Reduced railroad rates have been secured for this meeting.

A cordial invitation is extended to all ethical practitioners. Admission to the literary meetings and clinics can be secured by registering and presenting membership cards in the state or national societies. Headquarters will be at the Hotel Astor, and reservations should be made direct with the hotel management. For further information and programs address

A. P. BURKHART, *Secretary*,
57 East Genesee St., Auburn, N. Y.

NORTH DAKOTA STATE DENTAL ASSOCIATION

The annual convention of the North Dakota State Dental Association will be held at Grand Forks, May 18-20, 1926.

W. J. HEWITT, *President*,
Grand Forks, N. D.
FERDINAND B. PEIK, *Secretary*,
Carrington, N. D.

SOUTH CAROLINA STATE DENTAL ASSOCIATION

The next annual meeting of the South Carolina State Dental Association will be held in Columbia, at the Jefferson Hotel, May 10-12, 1926.

ERNEST C. DYE, *Secretary*,
Public Library Bldg.,
Greenville, S. C.

BOARD OF DENTAL EXAMINERS OF ALABAMA

The Board of Dental Examiners of Alabama will hold its next annual meeting for examining applicants for license to practice commencing at 9 o'clock, Monday, June 21, 1926. All credentials must be in the hands of the secretary at least two weeks before examination date.

E. W. PATTON, *Sec'y-Treas.*,
725 First National Bank Bldg.,
Birmingham, Ala.

ARKANSAS STATE BOARD OF DENTAL EXAMINERS

The Arkansas State Board of Dental Examiners will meet at the Marion Hotel, Little Rock, June 21-25, 1926.

WALTER E. HUTCHINSON,
Dermott, Ark.

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

Examinations will be held by the Board of Dental Examiners of California in San Francisco, May 29, and in Los Angeles, beginning June 26. All credentials must be in the hands of the secretary at least fifteen days prior to the examination or they cannot be accepted. For further information, address

O. E. JACKSON, *Secretary*,
155 Kentucky St.,
Petaluma, Calif.

BOARD OF DENTAL EXAMINERS OF THE DISTRICT OF COLUMBIA

The next examination of the Board of Dental Examiners of the District of Columbia for dentists and dental hygienists will be held June 14-18, 1926, at Washington, D. C. Applications should be in the hands of the secretary-treasurer ten days prior to June 14.

C. WILLIARD CAMALIER, *Sec'y-Treas.*,
Medical Science Bldg.,
Washington, D. C.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

The Florida State Board of Dental Examiners will hold its regular examinations at Jacksonville, commencing, June 22, 1926, and continuing for five days thereafter. License fee, $30. Attention is directed to the following, from the dental law of Florida: "Every person who desires to practice dentistry or dental surgery, or any branch thereof, within this state shall file with the secretary of said board a written application or a certificate and furnish satisfactory proof that he is at least twenty-one years of age, of good moral character, and he shall also file his diploma or certificate of graduation with recommendation from a high school, or a certificate signed by a state superintendent of public instruction, or similar officer, to the effect that such applicant has had scholastic preparation equivalent in all respects to that demanded for graduation with recommendations from a high school giving a four year course of instruction in the state from which such certificate is issued; and in addition thereto present evidence satisfactory to the board that he is a graduate of a reputable dental college as defined by the National Association of Dental Examiners. Such application must be upon the form prescribed and furnished by the board and verified by oath of the applicant." Application must be filed, complete, twenty days before the date of the examination. Address all communications for further particulars to

R. P. TAYLOR, *Secretary*,
114 St. James Bldg.,
Jacksonville, Fla.

IOWA STATE BOARD OF DENTAL EXAMINERS

The Iowa State Board of Dental Examiners will meet at the State University of Iowa College of Dentistry, Iowa City, June 1-4, 1926, at 9 a.m. for the purpose of examining applicants for license to practice dentistry. All papers and credentials must be filed with the department at least fifteen days prior to date of examination. An examination for dental hygienists will also be given. For further information and application blanks, address

STATE DEPARTMENT OF HEALTH,
Capitol Bldg., Des Moines, Iowa.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

The Kentucky State Board of Dental Examiners will hold its annual meeting for the examination of candidates for license to prac-

tice, June 1, 1926, at Louisville. For detailed information and blanks, address

J. H. BALDWIN, *Secretary*,
908 Francis Bldg.,
Louisville, Ky.

BOARD OF DENTAL EXAMINERS OF THE STATE OF MAINE

The Maine Board of Dental Examiners will hold its next examination at the State House, Augusta, June 24-26, 1926. Application with photograph and fee of $20 must be in the hands of the secretary not later than June 14. For further information and application, address

G. W. MACKAY, *Secretary*,
Millinocket, Maine.

MARYLAND STATE BOARD OF DENTAL EXAMINERS

The regular semiannual meeting of the Maryland State Board of Dental Examiners for the purpose of examining candidates will be held June 2-4, 1926, at the Dental Department of the University of Maryland, at 9 a.m. For further information and application blanks, address

T. L. MCCARRIAR, *Secretary*,
1822 North Charles St.,
Baltimore, Md.

MICHIGAN STATE BOARD OF DENTISTRY

The Michigan State Board of Dentistry will hold its next examination at the Dental College, University of Michigan, Ann Arbor, June 7-12, 1926, beginning at 8 p.m. For information and application blanks, address

J. W. LYONS, *Secretary*,
617-621 Dwight Bldg.,
Jackson, Mich.

MINNESOTA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Minnesota State Board of Dental Examiners will be held at the College of Dentistry, University of Minnesota, June 15, 1926. Applications must be in the hands of the secretary on or before June 14.

F. E. COBB, *Secretary*,
601 Donaldson Bldg.,
Minneapolis, Minn.

MISSISSIPPI STATE BOARD OF DENTAL EXAMINERS

The Mississippi State Board of Dental Examiners will convene on the third Tuesday in June at the State Capitol.

REUEL MAY, *Secretary*,
Jackson, Miss.

NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the North Carolina State Board of Dental Examiners will be held at Raleigh, beginning promptly at 9 o'clock, June 14, 1926. For application blanks and further information, address

F. L. HUNT, *Secretary*,
Asheville, N. C.

OHIO STATE DENTAL BOARD

The Ohio State Dental Board will hold the spring examination at the dental college of the Ohio State University, June 21-26. The dental hygiene examinations will be given, June 22. All credentials must be filed with the department at least ten days prior to date of examination. For further information and applications, address

RAY R. SMITH, *Secretary*,
327 E. State Street,
Columbus, Ohio.

STATE BOARD OF DENTAL EXAMINERS OF THE STATE OF OKLAHOMA

The next meeting of the Oklahoma State Board of Dental Examiners will be held in Oklahoma City, State Capitol Building, June 21-24, 1926.

CHARLES A. HESS, *Sec'y-Treas.*,
Idabel, Iowa.

SOUTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

The South Carolina State Board of Dental Examiners will hold its next examinations at the Imperial Hotel, Greenville, June 22-26, 1926. The attention of applicants for license to practice dentistry in the State of South Carolina is respectfully called to the following rules and regulations:

1. All applications must be in the hands

of the secretary ten (10) days before the meeting of the state board of dental examiners.

2. The minimum preliminary educational requirement is a state high school diploma or its equivalent fourteen (14) units, a certificate of which must be filed with the application.

3. Each application must be recommended by three ethical dentists from the applicant's home town or nearest towns.

4. Each application must be accompanied by a photograph of the applicant, on the back of which (photograph) must appear the signatures of three dentists who recommended the application.

5. Each application must be accompanied by a fee of $25.00.

6. Each applicant must present a diploma from a reputable dental college at the meeting of board.

7. The practical work in operative dentistry will consist of one gold foil filling, gold inlay, one silicate filling and one amalgam filling. Applicants must furnish instruments and material.

8. The practical work in prosthetic dentistry will consist of full upper and lower sets of vulcanite teeth articulated in wax. Applicants must furnish full upper and lower models on an anatomic articulator; also teeth in wax; the work to be done in the presence of the board.

9. The practical work in crown and bridge will consist of one three-quarter crown and one porcelain faced crown. Applicants must furnish articulated model, material and instruments.

10. Students who have finished the Junior year in college may take the written examination on all branches which they have completed, provided they comply with rules one to five inclusive.

11. The theoretical examination will consist of written examination on all regular college branches.

Members of the board are: W. K. Walker, Orangeburg, president; Frank Ferguson, Greenville; H. B. Hair, Columbia; W. B. Simmons, Greenville, A. H. Corley, Edgefield.

W. B. SIMMONS, *Secretary*,
107 E. North Street,
Greenville, S. C.

TENNESSEE BOARD OF DENTAL EXAMINERS

The Tennessee Board of Dental Examiners will meet at 9 a. m., June 21, 1926, at the Dental Department of Vanderbilt University, Nashville, for the purpose of examining all applicants who present credentials acceptable to the Board. (Hygienists will also be examined.) Bring credentials to the Board meeting for examination. Applications should be in the hands of the secretary five days before the Board meeting. For applications and clinical requirements, address

F. W. MEACHAM, *Sec'y-Treas.*,
911 Hamilton National Bank Bldg.,
Chattanooga, Tenn.

BOARD OF DENTAL EXAMINERS OF THE STATE OF WYOMING

The laws regulating the practice of dentistry in Wyoming and the rules of the board are essentially as follows:

An examination is required of all applicants and only holders of diplomas from reputable dental colleges are eligible to such examination. The board does not interchange with other states, nor issue any temporary permits.

No dentist can begin the practice of his profession in this state without first making application for an examination to the secretary of the board, and at the same time paying the examination fee of $25 and submitting his diploma for inspection.

The applicant will then be examined at the next meeting of the board, and if he passes a satisfactory examination, a license will be issued to him. Until he receives this license he is not authorized to begin practice and no license can be granted under the law except at a regular meeting of the board.

The possession of a diploma in itself gives no right to practice in this state.

One examination is held annually, the last week in June. The time, date and place are set by the Board. All applications must be completed and in the hands of the secretary fifteen days prior to the time set by the board for examinations to begin.

The written examination consists of anatomy, physiology, histology and bacteriology, chemistry and metallurgy, oral surgery, anesthetics, operative and prosthetic dentistry,

materia medica and therapeutics, prophylactics, orthodontia and dental x-ray.

Applicants must present a full plaster model of upper and lower jaws with teeth; also one without teeth. Practical work will be required from all candidates taking the examination. The candidate is required to furnish his own operating instruments, dental engine, amalgam, gold, wax and modeling compound.

The next meeting of the board will be held at Cheyenne, June 28-30.

For further information and application blanks, address

THEW J. ICE, *Secretary*,
Lock Box 116, Powell, Wyo.

ALUMNI ASSOCIATION, COLLEGE OF PHYSICIANS AND SURGEONS OF SAN FRANCISCO

The annual meeting of the Dental Alumni Association of the College of Physicians and Surgeons of San Francisco, School of Dentistry, will be held at the college, June 14-15, 1926. Clinics will be presented on every phase of dental practice. Dr. Albert Leland LeGro of Detroit, Mich., will lecture and demonstrate "The Modern Use of Dental Ceramics." Programs will be mailed June 1, 1926.

FREDERICK T. WEST, *Chairman*,
Publicity Committee,
2519 Mission St., San Francisco, Calif.

AMERICAN ACADEMY OF PERIODONTOLOGY

The thirteenth annual meeting of the American Academy of Periodontology will be held in the Commodore Hotel, New York City, Aug. 20-21, 1926.

M. H. GARVIN, *President*,
Winnipeg, Canada.
J. HERBERT HOOD, *Secretary*,
624 Hanna Bldg.,
Cleveland, Ohio.

OFFICIAL NOTICE TO DENTAL ASSISTANTS ASSOCIATION

The second annual meeting of the American Dental Assistants Association will be held in Philadelphia, Pa., Aug. 19, 1926. Members of the dental profession will address the various sessions. Clinics and papers will be given by the members of the Association and there will be a luncheon with guests and a program. All dental assistants are urged to plan their vacation so as to visit Philadelphia at that time and attend the meeting.

ANNA H. SYKORA, *General Secretary*,
8 West 40th Street,
New York City.

DINNER TO DR. WESTON A. PRICE

In appreciation of his contributions and inspiration to the profession, the W. D. Miller Club of Cleveland, on its tenth anniversary, will give a dinner in honor of Weston A. Price, D.D.S., M.S., F.A.C.D. The speaker of the evening will be Charles H. Mayo, M.D., M.A., LL.D., F.A.C.S., F.R.C.S. Make reservations, accompanied by check to the secretary. The dinner will be held during the meeting of the N. O. D. A., June 9, 1926, at 6 p.m. Tickets, $3.00 each. Guests and ladies invited.

S. F. M. HIRSCH, *Secretary*,
4900 Euclid Bldg.,
Cleveland, Ohio.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The Southwestern Society of Orthodontists announces the itinerary of a trip to the Seventh International Dental Congress meeting in Philadelphia, August 23-27, following the meeting of the Society in Houston, July 31 (Saturday). After a day of golf and a trip to Galveston, the party will leave for New Orleans (Monday, August 2, at 7 p.m.), spend Tuesday there and take the boat Wednesday, for New York. It is hoped to have a stopover of a day or two in Havana. The party will reach New York several days before the Congress opens, allowing time for shopping, sightseeing, theatergoing, etc. Members desiring to drive to Houston and ship their cars by freight boat to New York in order to motor back may do so. Dentists who are not orthodontists are also cordially invited to join the party. For further information, giving details as to all necessary expenses, etc., write immediately to

P. G. SPENCER, *Secretary*,
510-511 Amicable Bldg.,
Waco, Texas.

BOOKS RECEIVED

Chronic Infection of the Jaws, A Short Radiological and Clinical Study. By Stanley Colyer, M.D. (Lond.), M.R.C.P., D.M.R.E., Radiologist, Mildmay Mission Hospital; Late Assistant Radiologist, Royal Dental Hospital; to which is added a synopsis of a series of fifty illustrative cases by Reginald Curnock, L.R.C.P., M.R.C.S., L.D.S., Dental Surgeon to the Mildmay Mission Hospital. New York: The Macmillan Company, 1926. Pp. 75; illustrated.

Conduction, Infiltration and General Anesthesia in Dentistry. By Mendel Nevin, D.D.S., Oral Surgeon Greenpoint Hospital; Former Oral Surgeon Hospital Deformities and Joint Diseases; Ex-President Kings County Dental Society; Honorary Member Fraternidad Odontological Del Zulia; Honorary Member Southwestern Dental Society; Member Kings County (N.Y.) Dental Society, Second District (N.Y.) Dental Society, New York State Dental Society and American Dental Association; and P. G. Puterbaugh, M.D., D.D.S., F.A.C.D., Professor of Principles of Medicine and Anesthetics and Associate Professor of Oral Surgery, Chicago College of Dental Surgery. Ed. 2. Brooklyn, N. Y., Dental Items of Interest Publishing Co., 1924. 360 pp. 210 illustrations and large trifacial nerve chart.

The American Illustrated Medical Dictionary. A new and complete dictionary of the terms used in medicine, surgery, dentistry, pharmacy, chemistry, nursing, veterinary science, biology, medical biography, etc., with the pronunciation, derivation and definition, including much collateral information of an encyclopedic character. By W. A. Newman Dorland, A.M., M.D., F.A.C.S., Lieutenant Colonel, M. R. C., U. S. Army, Member of the Committee on Nomenclature and Classification of Diseases of the American Medical Association; Editor of "American Pocket Medical Dictionary;" together with new and elaborate tables of arteries, muscles, nerves, veins, etc.; of bacilli, bacteria, diplococci, micrococci, streptococci, weights and measures, posologic tables, eponymic tables of diseases, operations, signs and symptoms, stains, tests, methods of treatment, etc. Ed. 13, revised and enlarged. Philadelphia and London: W. B. Saunders Company, 1925.

According to the preface to this, the thirteenth edition, 2,500 new words have been added since the last edition. "All sections of medicine and the allied sciences have received attention as usual. The terminology of dentistry has been given special care; several hundred new dental terms have been added."

Pathology of the Mouth. By Frederick B. Moorehead, M.S., D.D.S., M.D., Dean and Professor and Head of the Department of Oral Surgery and Pathology, College of Dentistry, University of Illinois; Associate Professor of Surgery, Rush Medical College and University of Chicago; Oral Surgeon to Presbyterian and Children's Memorial Hospitals and to the Home for Destitute Crippled Children, Chicago; and Kaethe W. Dewey, M.D., Assistant Professor of Pathology, College of Dentistry, University of Illinois, Chicago. Philadelphia and London: W. B. Saunders Company, 1925. Pp. 540, 213 illustrations. Price $7.00.

According to the preface, it is hoped that this volume may call sharp attention to the magnitude of the mouth in disease, both in its local and general aspects, and stimulate a fundamental interest on the part of physicians and dentists.

Everyday Mouth Hygiene. By Joseph Head, M.D., D.D.S., Dentist to the Jefferson Hospital, Philadelphia. Ed. 2. Philadelphia and London: W. B. Saunders, 1925. Pp. 67. Illustrated.

PATENTS OF INTEREST TO DENTISTS

1476063. Sanitary toothpick receptacle, Anton F. Englerth, Chicago, Ill.

1476519. Toothbrush, William Karl and H. Karl, Jersey City, N. J.

1472646. Molding flask, George A. Glenn, Lawndale, Pa.

1472214. Dentiphone, John W. Gonce, Anderson, Tenn.

1476001. Investment material, Arthur M. McIntosh, Sydney, Australia.

1476460. Therapeutic cabinet, Henry C. Osborn, Cleveland, Ohio.

1477098. Dental tray, Louis Balter, New York, N. Y.

1476688. Flask filling machine, Edwin S. Carman, East Cleveland, Ohio.

1476699. Apparatus for producing local anaesthesia, Francois J. Fabert, Nice, France.

Copies of these patents may be obtained for twenty-five cents each, by addressing John A. Saul, Solicitor of Patents, 509 Seventh St., N.W., Washington, D. C.

THE PROFIT SHARING AUXILIARY OF COMMERCE

By Ernest V. Madison

Good advertising is a mutual profit distributor.

Financially speaking, an advertiser underwrites the initial expense of the advertising campaign. Additional sales and lower cost of production repay to him the amounts advanced for preparation, printing, postage and publication. The cost *vanishes.*

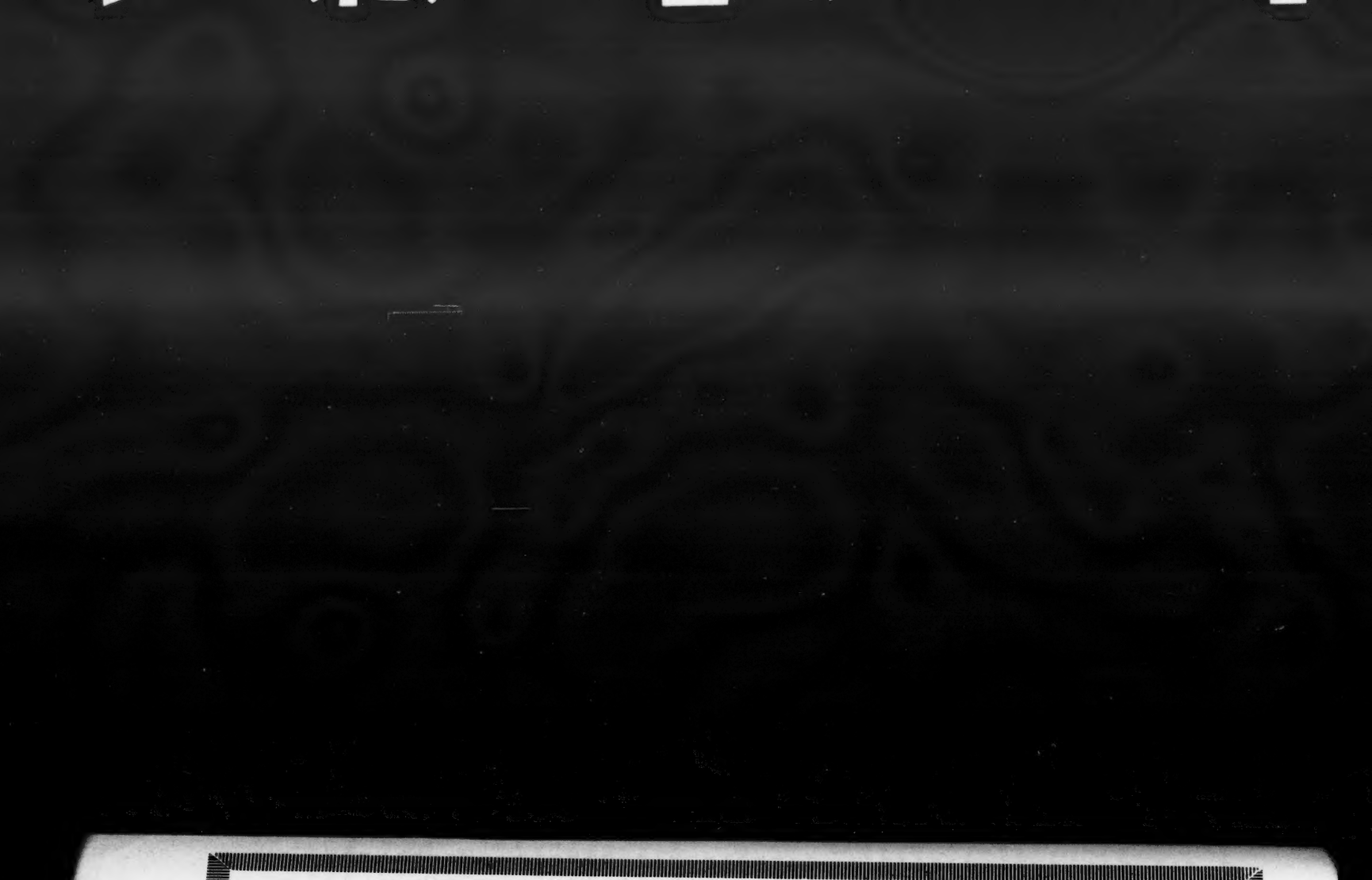
The buyer of the advertised product does not pay a cost for the advertising—*he saves through it.*

The automobile is a product advertised extensively, but cars do not cost more because of this advertising. *We have had frequent price reductions through recent years.* Automobile manufacturers have not been penalized financially because of their advertising outlay. *They are in a stronger capital-and-profit position than ever before.*

The cost of advertising is absorbed by the operating and merchandising economies of an increased business. Ultimately, these economies are passed on to the buyer in the form of a lower price or higher quality.

* * * * *

The advertisers in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION are deserving of our encouragement.

They are advertising to obtain new customers—to grow—to reduce seasonal or intermittent *wastes* of idle machines, idle operatives and idle floor space.

These are laudable ambitions.